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THE ELECTRIC LIGHT INDUSTRY.

The United States Census Office has issued this week a preliminary report on the figures which it compiled last year of the electric light industry in this country. These figures come in due sequence after those of the electrical manufacturing industries and the street railways, and will be succeeded by those on telephony and telegraphy. When the series is complete, at no very distant period, the public will be in possession of a body of most valuable data in regard to the new arts that have so distinguished the last fifty years, and whose exploitation has been so peculiarly a feature of American industrial advance. The great bulk of this data is, in fact, now collected for the first time, so that even here it is difficult to institute comparisons; while unfortunately hardly any country in Europe has yet begun to take statistical note in the same manner of anything but the governmental telegraphs and telephones. However, it may readily be believed that the example of the United States will be strongly stimulating in this respect, and that ultimately uniform methods will prevail for the collection of these important data throughout the civilized world, whose conditions are now being so markedly shaped by electrical influences.

The figures now published show 3,619 central station systems, with $502,000,000 invested, earning $85,145,423 a year, with expenditures of $67,688,075, inclusive of $12,501,045 interest on bonds, or exclusive of the interest, the expenditures were $55,187,030. This would show operating expenses of about 64 per cent. The figures of municipal plants are too small to disturb the general averages, but taking the private plants alone, it would appear that the $480,161,038 invested in them earns gross $78,180,318, with expenditures $50,445,848, exclusive of interest on bonds. This, it will be seen, works out at about 62 per cent. operating expenses, and shows a net of $27,734,470, or a return on bonds and stock capital invested of a little less than 6 per cent. Postponing further consideration of the other interesting data presented by the Census Office, it may here be noted that these figures do not by any means reveal the true extent of electric light and power development in America, for they do not include any isolated plants. In a city like New York there are hundreds of such plants, many of remarkable magnitude, and the country over there are probably not far from forty or fifty thousand of them—just how many will not be known until the next general census. It is sometimes assumed that all the isolated light and power plants equal in investment and capacity the central stations, and it is doubtless not far from the mark to say that electric light and power in this country reaches a total capitalization of $1,000,000,000, for it must also be borne in mind that thousands of buildings now have supply of current where the cost of installation has been met entirely by the customer, who has no plant of his own, and depends upon the local central station.

THE EFFECTS OF PLACING ALL CITY WIRES UNDERGROUND.

Only a few years ago the telephone, telegraph and electric lighting wires were all strung overhead, even in the largest cities. In New York City, for example, there once reigned a giant maze of overhead conductors in the principal thoroughfares. Owing to the accidents that occurred through frequent crosses, to the pressure of public opinion, and to the force of municipal ordinance, these wires have almost wholly disappeared from view, and have been buried

underground, except in certain districts or public byways, where overhead wires are less objectionable. It made but little difference to the electric light wires, from the operative standpoint, whether they went underground or not. The telegraph wires suffered to some extent by the transfer; but the telephone wires and systems suffered most of all.

The objection to underground wires does not lie solely in the expense of the transfer. A single overhead wire is far cheaper to install than a single underground wire. A dozen overhead wires are very considerably cheaper to install than a dozen underground wires. Two hundred overhead wires are, however, usually more expensive to install and to maintain than two hundred underground wires. The greater the number of wires to be run over the same route the relatively cheaper it becomes to place the wires underground. Consequently, the telephone engineer who carries a large number of wires along a given street is not likely to be perplexed by the necessity for burying the wires on the score of relative expense. The difficulty he experiences comes from the retardation and distortion of transmitted speech waves over the buried wires, owing to their greater capacity and resistance, together with their reduced inductance.

These conditions, taken with the ever-increasing areas of cities and the relatively great length of underground wires in cities, often bring on the result of imperfect communication between distant residents of the same city, owing to reaching the limits of effective length, or limiting distance of good speech transmission, with such buried wires in the city limits. Twenty miles of underground circuit in a city may give worse telephonic results than six hundred miles of overhead circuit. It is true that the modern method of loading telephone circuits either markedly increases the range or markedly improves the quality of telephonic speech; but even with the aid of loading, the constantly increasing lengths of underground wire connecting distant city exchanges make the problem of long-distance telephony continually more difficult to face.

Plotting of Speed-Time and Speed-Distance Curves.

The article by Prof. L. A. Freudenberger, appearing on page 219 of this number, in extension of the valuable Great Barrington Institute paper of Mr. C. O. Mailloux, forms an interesting contribution to the subjects of electric railway kinematics in general, and of predetermining electric railway schedules, in particular. It affords independent methods of predetermining the speed-time and distance-time curves of an electric car, when the profile of the road, the characteristic curves of the car motors, and the weights of the car are given. The methods depend upon the facts that the velocity-integral of acceleration-reciprocal is the time of action of the acceleration; also that the velocity-integral of the velocity per acceleration is the distance through which the acceleration acts. The ordinary characteristic curves of electric railway motor performance give the relation between current and torque, and also the relation between current and speed. They contain, therefore, implicitly, if not explicitly, the relation between torque and speed. That is to say, for every steady speed of the motors there is a definite torque. This will be correct within commercial limits when the rheostat is cut out, and will also be correct when the rheostat is in circuit, provided that the current strength in the circuit remains constant.

It is shown that since the torque-speed curve is either given, or may be drawn from the motor characteristics, the total tractive effort or equivalent draw-bar pull on the car at all speeds can be determined. By deducting the train resistance at various speeds, the residual accelerative tractive effort at all speeds becomes known. This gives the acceleration of the car at all speeds on a level track. The grades on the profile will increase or decrease these accelerations in known degree. With speeds as abscissæ, two curves can now be plotted, one a curve of reciprocals of acceleration and the other a curve of velocity divided by acceleration. The area enclosed by these curves with the base will then be the time and the distance respectively. The time will be the number of seconds required to attain the specified velocity, and the distance will be the number of feet run over from rest in reaching that velocity. Two new curves may now be drawn with the integrals thus obtained, and they will be the speed-distance and the speed-time curves of the run, respectively. The effects of curves and grades on the profile are included in the ordinary way.

The specific case computed deals with some observed cases of Mr. Mailloux taken under practical conditions. The speeds, however, reach sixty miles per hour, and the braking resistances have been extrapolated from speeds of fifty-five miles per hour from Mailloux's observations on braking at sixteen miles per hour. It is evident that experimental observations on braking electric cars at high speeds are much needed. The braking accelerations thus derived involve the second power of the velocity, as well as the first term and a constant. That is to say, the braking force is greater at high speeds than at low speeds, and increases faster than the speed. Even if this complexity be ignored, however, by taking the brake-retardation as constant, the error introduced into the results does not seem to be very serious. Whenever the labor of predetermining the schedule of an electric car from its motor characteristics is justified, there can be little doubt of the utility of these graphical methods of computation.

Current Classification and Literature.

The report of the Committee on Current Classification and Nomenclature appointed by the American Electro-Therapeutic Association has been published this year, and forms a useful compendium in electrotherapeutic literature of definition. There are special reasons for seeking to define the various electric currents employed electro-therapeutically. In the first place, much confusion exists in the old text-books on the subject, owing to misconceptions as to the nature and origin of electric currents. In the second place, the electric currents employed in electro-therapeutics are characteristic of the particular apparatus employed, and differ markedly in type from the electric currents used in other branches of applied electricity. Consequently, it is important to define and agree upon the terminology to be employed. Two distinct methods of classification have been adopted, viz.: one based on the source of the currents, and the other based on their type, or graphical representation.

On the former plan, currents are defined as voltaic, static, dynamic, dynamo-static, thermo, induced, reaction and shunted. This list seems to be satisfactory. The voltaic includes all battery currents or currents of electrochemical origin. It would not, however, include capillary currents or currents due to osmose. Consequently the term "endosmotic" might conveniently be inserted at this point to include electromotive sources of electrolytic nature other than electrochemical. Static currents are conveniently defined as currents obtained from electrostatic sources. When the electrostatic machine is a hydrostatic machine—a very rare practical condition—the currents might be aptly described as hydrostatic. Similarly the currents derived from a dynamo-static machine are described as dynamo-static currents. Induced currents are sufficiently definite and comprise

several subdivisions, such as primary-induced, secondary-induced and static-induced. Reaction currents are less definite and seem to be the least desirable item in the category. Thus, a steady electromotive force connected through resistance to a vacuum tube may set up periodic pulsations of currents in the circuit, owing to the periodic breaking down of the dielectric within the tube. A pulsating electromotive force may thus be derived from the terminals of the tube, and a pulsatory current through any derived circuit therefrom. This type of current is defined as a reaction current under the classification named, for the reason that a vacuum tube may be regarded as analogous to a condenser, and a condenser possesses reactance in an alternating-current circuit.

With regard to the second method of classification—by reference to current type—an important distinction is made between direct currents and continuous currents. A direct current is virtually defined as a current whose direction does not change, but whose magnitude with respect to time is purely arbitrary. A continuous current is a direct current with the prescription in regard to magnitude that it shall always be different from zero. That is to say, it shall always flow in one and the same direction, although it need not be always of uniform strength. A uniform continuous current is defined as a constant current. All these definitions seem very good and should be generally adopted. There is perpetual confusion in electric literature between the terms continuous current and direct current. This is partly due to the influence of French literature, in which the continuous current is generally defined like the direct current above referred to. Pulsating, alternating and oscillating currents complete the list, all in conformity with established electrochemical practice.

ECONOMY OF ENERGY.

There are times when every thoughtful engineer turns his mind to the great and pressing problems concerning the visible supply of energy—problems of most serious import to the growth of civilization, and to the prosperity of mankind. The fact is that the world's supply of fuel, while far from being exhausted, is depleted to an extent that is already beginning to be felt, and will year by year be felt more seriously. True enough, the situation last season was abnormal, and will not soon be duplicated, but nevertheless it served to show how grave an industrial crisis could be precipitated by even a small shortage of the annual coal supply. The total consumption of anthracite in this country is less than 20 per cent. of the aggregate coal consumption, and there was by no means a complete stoppage of the anthracite output, and yet the small extra demand sent the price of steam coal skywards with appalling rapidity. Of course, in the anthracite field there is practically a close monopoly and the price can be and is often put as high as the public can be bullied into paying. But with soft coal the case is different, and although the evil effect of combinations is felt to a certain extent there is no real corner. And yet the price is forced up by the operation of ordinary economic laws, owing mainly to the great corner in anthracite. The result is that steam coal, the great general source of energy, shows every indication of steadily rising in price from now on. We fear that this increase will continue without a material break. Many electrical stations felt the pinch last year and they must look forward now to steadily increasing fuel bills. We of the modern world have used our material resources like besotted spendthrifts drunken with the wine of overbearing prosperity, and the day of reckoning is drawing near.

We need not fear for a century or two to come anything like absolute exhaustion of the coal supply, even of civilized and accessible countries, but we shall find in a decade or two, and even now catch here and there, such shortage in the coal supply as will greatly enhance the cost of fuel in every manufacturing industry. It therefore behooves the engineer to cast about for means of help, and the task though not a light one is not by any means hopeless. To begin with, the day has gone by in which there is any economic justification in using simple noncondensing engines for any serious work, unless in the rare case of burning waste material unusable otherwise. With coal at a dollar a ton or so, the temptation was strong to put in a plant cheap in first cost and to trust to the cheapness of the fuel to offset its uneconomical use. In some cases, indeed, the cheap plant actually showed the best economic results, but we do not hesitate to say to-day that almost any refinement of apparatus that will save fuel will pay, if not this year then next, or five years hence, certainly long before its useful life is ended. The company that builds to-day and puts in the most economical steam plant that money will buy, may be considered extravagant; but ten years from now it will be solvent, while the others will have gone into bankruptcy or reorganized. When hard times come, as they assuredly will before many years, it is the fellow with the smallest running expenses that will weather the storm. Watertube boilers, the best furnaces that can be planned, every device that can utilize the waste heat, triple-expansion condensing engines, or turbines if they can hold their own—every per cent. of efficiency that can be juggled out of engine and dynamo—any and every means of keeping down the fuel bill—is fully justified under the conditions which now seem inevitably approaching. High pressures and superheating are coming and recent results abroad show plainly that they will pay.

How near to a pound of coal per horse-power-hour the performance of a big engine in regular use may come is as yet undetermined; but unless we miss our guess that sort of economy will not seem so nearly unattainable ten years from now as it does to-day. It is difficult to say, too, what are the commercial possibilities of large gas engines. In theory they are very great, and surely if the gas engine can be made to double the thermodynamic efficiency of the steam engine, as seems possible, it must be taken very seriously as a future prime-mover. But we must not forget that for electrical purposes the real question is not alone engine performance, but the amount of saleable energy that can be extracted from a pound of fuel. It therefore behooves the engineer to get after the electrical losses as far as is possible. A recent report of the National Electric Light Association on which we commented at the time gave a vivid idea of the leaks that may exist between the switchboard and the returns from the consumer's meters. It pays in the long run to keep after these small, or sometimes large, losses. It is certainly well within bounds to say that in many a station to-day the output sold per ton of fuel consumed might be increased thirty per cent. without going into any questionable refinements. This increase is quite enough to make the difference between dividends and a receiver, and we will go still further any say that not a few stations will earn the latter before the former unless they realize the drift of events and study the business of power saving. We will not here speculate on the possibilities of replacing the use of fuel by water power, or wind power or sun power—these are questions not of to-day, but of a long to-morrow. But the fuel bill is imminent, insistent, not to be escaped, and those improvements which are able to lessen it are necessary improvements. In the power station the question no longer is how cheaply it can be built, but how cheaply it can be operated. If any step toward economy is advisable now, it will be absolutely necessary five or ten years from now, and electric power stations should be regarded at least in that degree as permanent investments.

Statistics of the American Electric Light and Power Industry.

The Hon. S. N. D. North, Director of the United States Census Office, has given to the press this week a preliminary report on the statistics of the electric light and power industry, as compiled by Mr. W. M. Steuart, chief statistician of the department of manufactures, Mr. T. C. Martin being special expert agent associated with the work. It will be remembered that the statistics of the street railway industry were similarly issued a few months ago, and that a bulky bulletin has just been issued on that subject. The figures of the telephone industry will, in turn, follow in a few months, and the telegraph industry will come last of all.

The figures given below are for the results at the end of the year closing June 30, 1902. The report includes central stations only, and does not embrace any isolated plants, plants operated by electric railway companies or idle plants, or plants under construction. It may be recalled here that the street railway census showed 118 trolley companies to be in the light and power business, earning gross from it $6,469,726, and that all told this item, including sale of current reached $7,703,574.

CENTRAL ELECTRIC LIGHT AND POWER PLANTS.

	Total.	Private.	Municipal.
Number of establishments	3,619	2,804	815
Cost of plants	$502,181,511	$480,161,038	$22,020,473
Earnings from operation, total	83,585,410	76,748,554	6,836,856
From light service	69,731,931	62,983,068	6,748,863
Arc lighting	25,459,437	22,070,192	3,389,245
Commercial or private	8,443,280	8,203,114	240,166
Public	17,016,157	13,867,078	*3,149,079
Incandescent lighting	44,272,494	40,912,876	3,359,618
Commercial or private	41,536,392	38,668,096	2,868,296
Public	2,736,102	2,244,780	*491,322
All other electrical service	13,853,479	13,765,486	87,993
Income from all other service	1,560,013	1,431,764	128,249
Gross income	85,145,423	78,180,318	6,965,105
Expenses:			
Total	67,688,075	62,442,088	5,245,987
Salaries and wages	20,551,989	18,672,267	1,879,722
Supplies and materials	22,814,758	20,392,467	2,422,291
Rent of stations and offices	1,285,546	1,270,798	14,748
Taxes	2,654,065	2,643,945	10,120
Insurance	886,445	820,804	65,641
Miscellaneous	6,994,227	6,645,567	348,660
Interest on bonds	12,501,045	11,996,240	504,805
Power-plant equipment:			
Steam engines—			
Number	5,921	4,861	1,060
Horsepower	1,377,041	1,230,023	147,018
Water wheels—			
Number	1,378	1,296	82
Horsepower	381,134	369,916	11,218
Generating plant:			
Dynamos—			
Direct-current, constant voltage—			
Number	3,820	3,402	418
Horsepower	441,621	418,088	23,533
Direct-current, constant amperage—			
Number	3,537	2,955	582
Horsepower	195,431	157,668	37,763
Alternating and polyphase current—			
Number	5,106	4,284	822
Horsepower	978,428	887,740	90,688
Output of station:			
Kilowatt hours—total for year	2,437,218,732	2,241,314,293	195,904,439
Line construction:			
Miles of mains and feeders	12,470,494	10,936,603	1,533,891
Lighting service:			
Arc lamps—			
Total number	385,208	334,413	50,795
Commercial or private	173,502	167,709	5,793
Public	211,706	166,704	45,002
Incandescent lamps—			
Total number	18,006,521	16,429,060	1,577,461
Commercial or private	17,552,756	16,058,111	1,494,645
Public	453,765	370,949	82,816
Average number of employees and total salaries and wages:			
Salaried officials and clerks	6,976	6,026	950
Salaries	$5,632,880	$5,175,499	$457,381
Wage earners	23,258	20,791	2,467
Wages	14,919,109	13,496,768	1,422,341
Foremen and inspectors	1,560	1,478	82
Wages	1,358,272	1,297,585	60,687
Engineers and firemen	8,020	6,671	1,349
Wages	5,201,988	4,416,929	785,059
Linemen	4,209	3,860	349
Wages	2,704,529	2,503,957	200,572
All other employees	9,469	8,782	687
Wages	5,654,320	5,278,297	376,023

* Estimated value if paid for at prevailing rates.

The final report will contain an analysis of the above totals, and present detailed statistics by states and for other phases of the industry. The statistics for this industry at the census of 1890 were confined to the State of New York, the city of St. Louis and the District of Columbia, therefore no comparison can be made with the totals for the United States. In other words, these are the first and only authentic figures of the industry in America.

Trolley Road Network for Long Island.

Long Island, with but one steam road, and with numerous small and scattered communities yielding little support for a steam system but still needing frequent communication, is an ideal territory for interurban trolleys, and plans are now being pushed it would appear for the creation of such a network at the hands of a group of Western capitalists. Last week more tban two hundred miles of electric railway, extending throughout Queens and Nassau Counties, passed into the control of these interests, said to include Mr. C. Schwab, the United States Mortgage and Trust Company acting as the clearing agent. The deal was put through by William K. Giles, of No. 41 Wall Street. It is known that both the Pennsylvania Railroad Company and the interests represented in the subway transit have had an eye on these roads, among which is the New York and Queens County Electric Railway, which was owned by a Philadelphia syndicate, and of which W. R. Shelmerdine, of Philadelphia, was president. This road operates branches extending all through Queens, to College Point, Flushing and Jamaica, and all through Long Island City. It also controls the New York and North Shore Road, which extends through Jamaica and Far Rockaway, and connects at Queens with the Nassau County Electric Railway, another branch which connects villages in Nassau County, and expects to send connecting lines into Suffolk County. The tracks of this railway also go to the new race track now being built on the line between Nassau and Queens Counties, to be known as Belmont Park.

The plan of the promoters is to build an up-to-date trolley system that shall traverse Long Island from east to west—from Brooklyn to Orient Point on the north and to Montauk Point on the south, with intermediate cross lines, some six or eight in number. One of the companies that has had surveys made along the lines of its projected roads is the Brooklyn, Bay View Landing, Freeport and Mineola Transportation Company. Another line is the Bayside and North Shore Transportation Company. Another corporation mentioned is the South Side Traction Company, which has obtained rights of way east and west of Patchogue, and is endeavoring to secure others so as to reach projected lines to the west. Still another enterprise, also said to be a branch of the scheme, is the Long Island Traction Company, now engaged in getting franchises between Riverhead and Orient Point. It already has secured the rights of way between Riverhead and Mineola. From Riverhead it is trying to get further rights of way to Patchogue. A line is also being projected between Huntington and Amityville; still another from St. James to Babylon, and it is reported, articles of incorporation are to be filed for another company, which will run from Sea Cliff to Massapequa. Even this does not exhaust the list of roads which might become either valuable feeders or important rivals of the Pennsylvania-Long Island Railroad system.

Wireless Telegraph Conference.

A special cable dispatch from Berlin of August 3 says: "The international conference on wireless telegraphy, at which is to be discussed the formulation of regulations for governmental control of the industry, will assemble to-morrow in the Imperial Post Office building. Germany, Great Britain, France, Russia, Austria-Hungary, Italy, Spain and the United States will be represented. The American delegates are General. Greely, Chief Signal Officer U. S. A.; Commander Barbour, U. S. N., and John I. Waterbury, of the New York Chamber of Commerce. There will be no representatives of companies or inventors present."

Hydraulic-Electric Development of the Neversink Light and Power Company, Middletown, N. Y.

AN interesting hydraulic-electric development has recently been completed in the Neversink Valley, Orange County, N. Y., through the use of the abandoned works and canal of the Delaware & Hudson Company. The old Delaware & Hudson Canal, which during more than half a century served for the transportation of "stone" coal from the region of Pennsylvania to Kingston, N. Y., on the Hudson River and to tidewater, was abandoned under a special act of the New York State Legislature passed in 1900. The canal has always taken its supply of water for its highest level, known as the "Summit," from the Neversink River, of Ulster, Sullivan and Orange Counties, N. Y. The canal company maintained a dam across the river which diverted the water into a feeder about one mile long, the lower end of which supplied the canal at such an elevation as to permit the canal being carried across and above the river by means of a cable suspension aqueduct. The hydraulic development, including the dam, feeder and the part of the canal now owned by the Neversink Company, cost the Delaware & Hudson Company originally considerably in excess of a quarter of a million dollars. The abandonment of these works for canal purposes made them readily available for the hydraulic power development, and by raising the embankments a head of about 40 ft. was afforded at the lower end of the feeder. Reference to the accompanying map will show the relative location of the dam, river and canal.

About a year ago the Neversink Light & Power Company entered

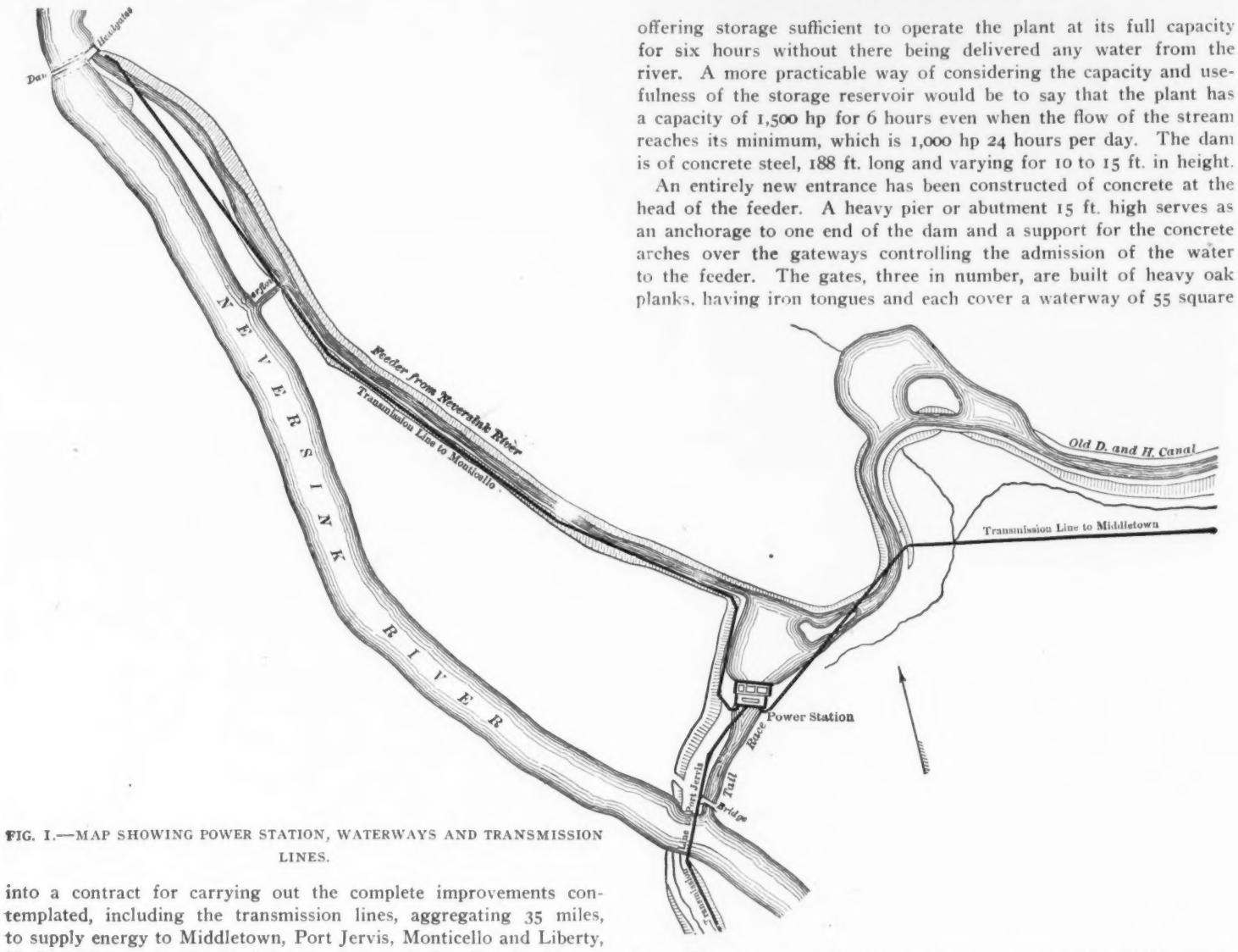


FIG. 1.—MAP SHOWING POWER STATION, WATERWAYS AND TRANSMISSION LINES.

into a contract for carrying out the complete improvements contemplated, including the transmission lines, aggregating 35 miles, to supply energy to Middletown, Port Jervis, Monticello and Liberty, N. Y. The work was carried on so energetically that despite unforeseen difficulties in execution, labor troubles and delays of manufacturers in deliveries of apparatus, the plant was put in operation the first of the present year.

In order to secure the advantages of a storage reservoir, the Neversink Company acquired title to about two miles of the canal. A cut-off dam was built across one end of the canal and the other end enlarged so as to make a good-sized basin or forebay, into which the feeder empties and on which is located the power house. This forebay with the two miles of canal and the one mile of feeder and the considerable poundage above the dam makes a reservoir

FIG. 2.—TAIL RACE.

offering storage sufficient to operate the plant at its full capacity for six hours without there being delivered any water from the river. A more practicable way of considering the capacity and usefulness of the storage reservoir would be to say that the plant has a capacity of 1,500 hp for 6 hours even when the flow of the stream reaches its minimum, which is 1,000 hp 24 hours per day. The dam is of concrete steel, 188 ft. long and varying for 10 to 15 ft. in height.

An entirely new entrance has been constructed of concrete at the head of the feeder. A heavy pier or abutment 15 ft. high serves as an anchorage to one end of the dam and a support for the concrete arches over the gateways controlling the admission of the water to the feeder. The gates, three in number, are built of heavy oak planks, having iron tongues and each cover a waterway of 55 square feet. The gates are operated by massive geared crabs, which permit one man to hoist or lower a gate under the extreme conditions of head and pressure to be met.

A unique feature of the installation is the use of concrete steel

in the design of a combined dam and power house. The structure was built directly across the old canal and although there is a head of 23 ft. on the walls surrounding the wheel chambers the walls themselves are only 3 ft. thick at the bottom, tapering to 14 in. at the top. If steel had not been used with the concrete and the walls properly designed to withstand the overturning moment, they would have been perhaps 10 ft. thick at their base.

In front of the penstocks is a large chamber running entirely across the front of the building with concrete walls on either end and an iron inclined rack on its front to prevent ice and debris from entering the wheels. The rack is supported on a massive iron beam construction and has an area of some 1,200 square ft., so that the velocity of the water even when the wheels are operating at full gate will not exceed .3 (3/10) of a foot per second.

The wheel chambers are each provided with three oak gates of sufficient area to allow slow movement of the water to the wheels. The gates are similar to those at the head of the feeder and are operated by crabs on top of the masonry.

The power house is of concrete steel throughout, including the roof, floors and girders, walls and foundations, and is built under the Ransome patents. The building is 40 ft. x 60 ft. in plan and is 45 ft. in height.

FIG. 3.—LIGHTNING ARRESTER ROOM.

Three wheel chambers are provided, two of which contain pairs of 27-in. horizontal S. Morgan Smith Company, McCormick wheels, and also a single 15-in. wheel direct-connected to an exciter. The third wheel chamber has been built with the expectation that another 550-hp until, the size of those already installed, will be later added when the market for the power is developed. Each pair of large wheels and each exciter wheel is provided with a 17-ft draft tube.

The steel flume heads are built into the concrete-steel wall, separating the wheel chambers from the dynamo room. The shafts of the wheels project through the flume heads and by means of flexible couplings are direct-connected to the alternators and exciters. The generators were furnished by the General Electric Company and are each of 300-kw capacity, three-phase, 60-cycle, 600 volts, revolving field type, running at 300 r.p.m. The exciters are each of 30-kw, 125-volt, direct-connected type of sufficient capacity to excite all three alternators. The switchboard is of marble, also furnished by the General Electric Company, and supplied with all the latest and most approved instruments, in the way of voltmeters, wattmeters, switches, etc.

The switchboard is equipped with two sets of three-phase bus-bars, from which current is supplied to two separate banks consisting each of three transformers. Current from the transformers is fed to two separate sets of three-phase, high-tension bus-bars, running the length of the station. Each conductor of the six three-phase circuits entering the building may be connected by means of a jaw switch to either set of the high-tension bus-bars, providing an arrangement for supplying any transmission line from either generator or operating the railway and motor load in various towns from one set of bus-bars with its generator, and the lighting load from the other set with its generator.

FIG. 4.—POWER HOUSE.

The step-up transformers are of the oil-insulated, self-cooling type. Those in the station are of 100-kw capacity, each provided with special taps to permit of adjustment of the voltage and installation of the Pearson-Cutcheon Lightning Protection device. The transformers step up from 600 to 10,000 volts, which latter pressure is the potential of transmission on all circuits. The step-down transformers in Middletown and Port Jervis are each of 50-kw capacity, and they are also provided with taps for adjustment of voltage. They were furnished by the Westinghouse Electric & Manufacturing Company.

Two types of governors are used and an interesting test as to their comparative merits in controlling the speed of the water wheels is being made. One governor of each make has been installed and as each controls the speed of a separate generating unit, in all respects identical with the other, every facility is offered for determining which governor is the most satisfactory both as to speed regulation and general working.

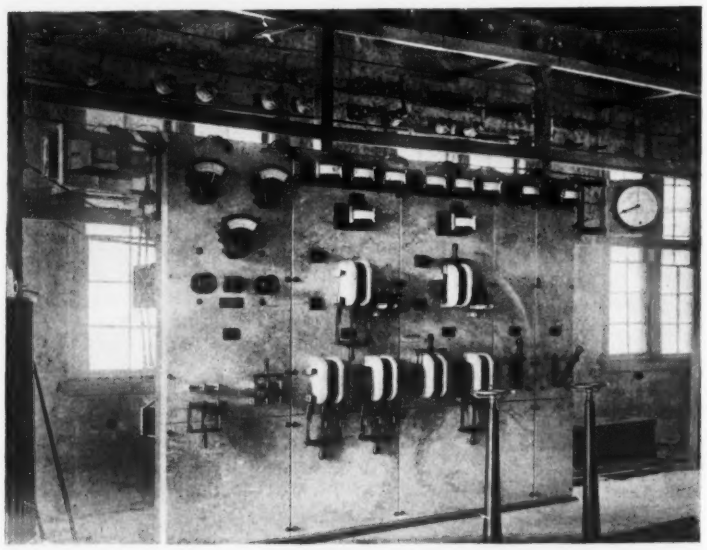


FIG. 5.—SWITCHBOARD.

The station is provided with an overhead traveling crane furnished by the Niles Tool Works, electric heaters, telephone switchboard, air compressor and the other small but necessary adjuncts for a complete station.

The three transmission lines are built in the most thorough and

substantial manner. On all lines the poles are 30 ft. or more in length and 7 in. in diameter at the top, set 5 ft. in the ground and spread 120 ft. apart. They are each equipped with two cross arms for the twin three-conductor transmission circuits, and one cross arm for the metallic return telephone line. The poles are double-cross-armed and guyed at road crossings or slight angles with special three-pole construction at right angle turns. Special high-tension locust pins with Floy triple petticoat glass insulators are used for the high-tension lines. The cross arms are braced and bolted to both the poles and braces.

In order to determine whether copper or aluminum conductors are the more satisfactory, there has been installed on each transmission line one circuit consisting of three hard-drawn No. 6 copper conductors and another circuit consisting of three No. 4 seven-strand aluminum conductors.

A novel and what seems unusually satisfactory method of introducing the bare transmission line conductors within the building has been adopted. A gallery overhangs the tail race making a separate room used as a lightning arrester house which extends across the entire south side of the main building. Each bare wire of the 10,000-volt transmission line enters the building first perpendicularly through the floor of the lightning arrester gallery and then horizontally through the wall dividing the lightning arrester room from the generator room. Iron brackets are set both in the floor and dividing wall, so that each conductor is rigidly supported in the center of a circular hole in both the floor and wall. As the conductor slopes downward from the last pole on the transmission line to the insulator below the lightning arrester gallery and at that point turns abruptly upward, rain following the conductors runs to the insulator and so drops off without entering the building. The arrangement permits the naked conductor to pass through the walls of the building, but also prevents any rain or snow blowing in.

Throughout a large part of their length the transmission lines are built across private property in order to secure the shortest route and a right of way which avoids special franchise tax and future controversies. To convey the right to erect, maintain, patrol and

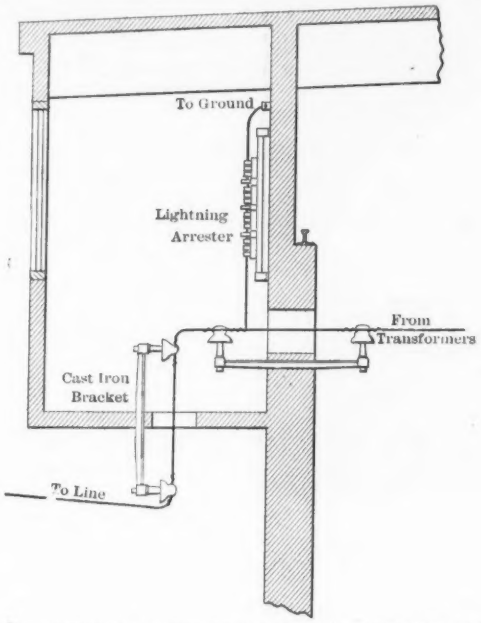


FIG. 6.—SECTIONAL VIEW OF LIGHTNING ARRESTER HOUSE.

operate the transmission lines across such lands there were prepared and used a uniform deed, with spaces left blank for necessary insertion, so that future litigation is forever avoided.

The president of the Neversink Light & Power Company is Dr. Henry C. McBrair, of Middletown, N. Y., who first recognized the value of the power purposes of the abandoned canal and with indefatigable energy secured control of the properties and arranged for the completion of the development. The Henry Floy Company, of New York, was the contractor for the improvement, including the earthwork, dam, power house, transmission lines and installation of machinery. Mr. W. A. Gordon, as resident engineer in charge of the work, should be mentioned for the very creditable way in which the details have been carried out and the engineering difficulties overcome. Mr. C. E. Breckenridge, of the same company, has had charge of the installation of the transmission lines, which are more than usually substantial and well built.

The Monument to Galileo Ferraris in Turin.

BY ADOLFO G. B. HESS.

On February 27, 1897, Prof. Galileo Ferraris died suddenly in Turin, Italy. The genuine sorrow which was felt at his untimely death, not only in Turin and all Italy, but in other lands, can hardly be expressed in words. It was the grief of a whole nation, which sighed at the passing away of one of its greatest celebrities, of a scientific world losing one of its most brilliant and beloved apostles, and the sorrow of youth generally who saw disappear from their midst a master and a father for whom they entertained the most profound veneration.

The object of this article is to present some of the reasons for this sincere affection for Ferraris, in order that the deep significance expressed in the monument recently raised to his memory in Turin can be readily understood. This monument is the creation of the young and talented sculptor, Luigi Contratti, of Brescia, and has

GALILEO FERRARIS.

been erected in the center of the Piazza Castello, where the population of Turin were wont to see the genial, pensive and sympathetic face of the discoverer of the rotary field.

Galileo Ferraris was born on the 30th of October, 1847, in Livorno Vercellese, Piedmont. The desire for knowledge manifested itself in his early youth. At that time there were no public kindergartens, and children under seven years of age were not admitted to the public schools of the city. One day when little more than six years old, the child took a number of books, such as he was able to find at his home, and without telling anyone of his purpose, went to the public school and took a seat, without asking, in the fourth class. The master naturally inquired what he wanted, and received the quick reply: "I do not want to become a donkey" ("Non voglio mica diventare un asino io!"). He was permitted to remain and was assigned to a class.

When in the High School (Gymnasium) he began to show his preference for physics and mathematics. Graduating from the engineering course in 1869, the subject of his thesis was: "Hirn's Telodynamic Transmission," thus demonstrating his interest even at that time in the problem of transmission of energy over great distances. Later he became assistant professor of physics in the Royal Industrial Museum of Turin. In 1872 he read an important paper on the subject of "The Theory of the Conduction of Electricity in Homogeneous Solids," and soon after one entitled "The Cardinal Properties of Dioptrical Instruments," followed by one on "The Intensity of Telephone and Induced Currents." In 1878 he was elected professor to the chair which he had filled so well as assistant, and a little later he became instructor of physics at the Superior Military Academy. In 1881 he was appointed representative of the Italian Government at the International Electrical Exposition at Paris; in 1882 he went to the International Electrical Conference

in Paris in the same capacity and in 1883 to the International Exposition at Vienna.

At the International Electrical Exposition at Turin in 1884, Gaulard brought his transformer before the public, which had previously been experimented with in England by Dr. John Hopkinson. Ferraris at once saw the importance of this apparatus, and it led to his taking up the study of alternating currents. At the Turin Exposition and later in his laboratory, he made this transformer the subject of experimental and theoretical study, which formed matter for a paper entitled "Theoretical and Experimental Researches on the Gaulard and Gibbs Secondary Generator." Shortly afterwards he experimented with a Ganz transformer. These studies led to the conception of the magnetic rotary field, which was arrived at through analogy by considering two polarized luminous rays displaced in phase and which combine elliptically in one ray. He proved the correctness of his theoretical views by experiments in the laboratory of the Industrial Museum of Turin in August, 1885. Although these results were known to friends and to the pupils who followed his lectures at that time, they were not published until the beginning of 1888 in a paper read before the Academy of Sciences of Turin.

In 1888 an electrotechnical high school which he proposed was authorized. At the exposition at Paris in 1889, Ferraris could have seen two applications of the principles which he laid down—the motors of Tesla and Rankin Kennedy. The first important and conclusive demonstration of his principle which he witnessed was, however, at Frankfort in 1891, when electrical energy was transmitted from Lauffen to Frankfurt, a distance of about 110 miles. The reception accorded him by the electrical engineers gathered at Frankfurt could not have been more flattering, by whom he was acclaimed the discoverer of the rotary magnetic field, or "Drehfeld," or "Ferraris-Feld," as it was called at that time.

Prof. Ferraris was named a delegate to the World's Columbian Exposition at Chicago in 1903. Prof. Carhart, in an article published in the ELECTRICAL WORLD AND ENGINEER (February 15, 1897), speaks very highly of the part which Ferraris took in the congress, and Ferraris expressed himself enthusiastically about the warmth of the reception which was accorded him in America. On August 22 he wrote from Chicago to his intimate friend, Candellero, to whom he had sent a number of the ELECTRICAL WORLD, containing his biography, as follows: "And all that which you can gather from the treatment accorded me by the journal, is exactly what I would tell you, if I wished to describe to you all the courtesies and signs of distinction of which I was made the object in America."

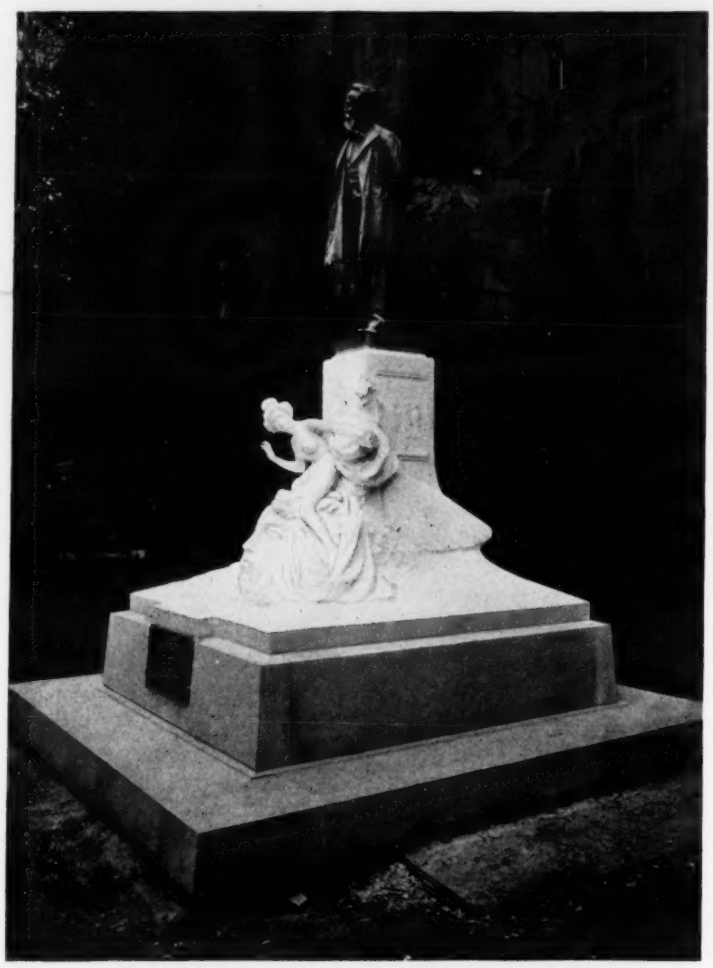


FIG. 2.—FERRARIS MONUMENT IN TURIN.

At the Chicago Exposition, Ferraris was elected a vice-president of the congress, together with Mascart, of Paris; Preece, of London; Voigt, of Munich; Weber, of Zurich, and Elihu Thomson, of Boston. A few days later he gave Candellero an account of the work done at the congress: "The value of the international ohm and all units of measurement related to it were definitely defined. The definition of the joule and the watt were formally and officially sanctioned; a name was finally agreed upon for the unit of measurement of electromagnetic induction, accepting with great satisfaction to the American people the name of "Henry," which had been proposed by the American Institute of Electrical Engineers some time before. Not much that was new was accomplished as far as magnetic measurements were concerned; however, one very important feature was that there were officially and definitely buried multifarious and strange propositions which had popped up and had been accorded a reception worthy of a better cause. . . . . "

"So much for the congress. As for me, I must inform you that I am very much pleased that I came here, and that I am satisfied with the good reception which was accorded me, as well as the part which I was able to take in the discussions. I shall never forget the impression made on me by the flattering attention with which the colleagues of the congress listened to me and the fervor with which they accepted the propositions and observations which I put before them."

On another occasion he spoke very enthusiastically about what he was able to see in America: "There," said he, "labor, production and the useful circulation of matter and energy are the climax of all thought. Seen from there, the dreadful dangers which appear to threaten the Old World dwindle to ordinary controversies of no moment. A young people, in an enormous country, on rich and virgin soil, alone and secure, a people temperate in the battle of life, free from any bondage and embarrassment due to past prejudices and armed with all means with which modern mechanics enlarges the field of humanactivity. . . . . "

His artistic and pensive soul reveals itself when he also says: "A life entirely absorbed in business, no matter to what extent it may be embellished by wealth and domestic comforts, is not worth more than one less successful, less wealthy, but more reposeful, and allowing of some time for the enjoyment of the beautiful and the abstract. I prefer a bed, not so soft, and a room not so profusely decorated, if I have a volume of Horace, Virgil, Beethoven or of Wagner on my table. Furthermore, taking everything into consideration, it seems to me that an education which does not include the beautiful in literature and the beautiful in the pure sciences cannot be called perfect."

Comm. Eng. G. B. Maffiotti, director of the Royal Industrial Museum at Turin, writes: "Without being a poet or artist in the strict sense of the word, Ferraris loved and understood poetry and art, as is shown by the idealism expressed in all his utterances and writings. He was blessed with an excellent memory which was nothing more than one of the phases of his multifarious and thoughtful intelligence, enabling him to repeat even during the last years of his life many poems which he learned at the Lyceum. . . . . He could draw with taste and expression. Among his papers there were often found memoranda on which appeared algebraic formulas and diagrams of electrical apparatus, intermingled with sketches which may have been put in at intervals, during the moments when, his mind overtaxed with scientific research, he loved to take a rest by allowing it to wander off into the cheerful fields of art.

"His artistic genious was particularly revealed in music, which was his chief recreation during the short periods of time he allowed for repose, and his comfort in moments of sorrow. But in music, as well as in science, he loved to soar. That explains his passion and enthusiasm for Wagner's music, of which he knew every note. He used to say jokingly that it would be sufficient to call him back to life, should he lie dying."

I will always hold as a most pleasant recollection several days

spent at Courmayeur, the region which may be called "Italian Switzerland," at the foot of Mont Blanc. Galileo Ferraris also visited this region in order to strengthen himself in the pure air of the mountains and to divert his thoughts admiring a nature exceptionally sublime. Poet in the bottom of his soul, he felt fully the fascination of the supreme beauty of the glaciers glittering in the sun and cleft by fearful, towering projections of jagged rocks. His constitution, which was not very robust, did not permit him to make actual ascents, but as often as he could, he used to walk several hours' distant from Courmayeur to the points most adapted for the enjoyment of the majestic panorama, of the numerous chains of mountains submerged in an atmosphere of light and colors. Returning to the hotel still under the impressions of the sublime view, he sat down to the piano to express his intense feeling in music.

Among his favorite music was Mendelssohn's "Lieder ohne Worte" (Songs without Words). And it was just while he was playing these songs that I learned to know and to admire his taste for music —in a few words, to love him and to wish that I would be fortunate enough to have him as my master as soon as I were ready to take up the study of electricity. Unfortunately, it was a vain desire on my part; he passed away too soon!

Galileo Ferraris was an effective speaker, and impressive and efficient in speech from his clearness and exactness of expression and from the logic of his reasoning. He also was possessed of the practical sense of an engineer, and by coupling theory with the practice, he succeeded in making the science popular while enabling his pupils to grasp the most abstruse electrical problems.

He wrote considerable during his active life. Among his papers are the following: "A Method for the Treatment or Rotating Vectors," "On a Synchronic Electric Alternating Motor," "Theorems Regarding Distribution of Constant Electric Currents," in which he deduced the principle of Ohm from the principle of "maximum work," as a consequence of the law of Joule. Later he wrote the paper above referred to on "Theoretical and Experimental Researches with the Secondary Generator of Goulard and Gibbs" and "On the Displacement of Phases of Currents, on the Retardation of Induction and on the Laws of Energy in Transformers." In 1896 he made known a new system of electrical distribution of energy by alternating currents, which he worked out with Prof. Arno, his assistant, and consisting in deriving from a monophase circuit, a polyphase circuit by means of a monophase asynchronic motor (Brown type). He published a lecture on "Transmission of Electrical Energy," and after his death a work was published on "The Geometrical Theory of Vectorial Fields."

At the end of 1896 he was elected Senator of the United Kingdom. This dignity, which gave him much pleasure, brought him new duties and new labors, adding to those of professor, municipal counsellor and consulting engineer. The increased work killed him little by little. On February 1, 1897, while lecturing, he became ill and said: "The engine is broken down; I cannot continue." These were the last words which he uttered to his pupils. Six days later he was no more.

Maffiotti writes of him: "Electrician of worldwide fame at a time when electrical industries developed themselves with an impetus never before experienced, through his ingenious discoveries he gave to them an added impulse and a new vigor. In him one can say the electrical science was personified in Italy. He could have easily amassed riches, but shrank from all utilitarian speculations. He cultivated science for the sake of science, thinking that its priests must not ask from it more than intellectual satisfaction. These sentiments he expressed in his lectures, in his writings, everywhere and always.

"Pondering over the life of Galileo Ferraris, over what he did and could have accomplished, over his early death and the causes which provoked it, we are almost led to complain that he lacked that selfishness which is a condition of our self-preservation and which we could excuse in one whose life was so precious to science. But the intellect and heart of Galileo Ferraris formed such an exquisite whole that parts could not be modified without destroying the admirable harmony which existed between them and which rendered the personality of this apostle so fascinating. He was only of medium stature, of slight physique and his features, though not classical were sharply defined. He possessed a penetrating glance, his broad forehead betrayed the presence of genius and his smiling lips gave proof of the unlimited riches of his heart. Worn out by that interior fire, his body now reposes free from any mortal fatigue. Long live the spirit, long live the cultivation of his spotless memory; long will live his useful, fruitful, educational work."

Preece said of him: "I had the pleasure of the personal acquaintance of Galileo Ferraris, and a more charming companion I never met. His scientific work was thoroughly appreciated in England and his labors are bearing practical fruit every day. Electrical progress owes a deep debt of gratitude to Ferraris." And Elihu Thomson says: "Dr. Ferraris was a man of the highest scientific attainments. To meet him personally was to discover in him those lovable traits of character which endeared him to all. Such truth and gentleness leaves memories which are not defaced by time. It is needless for me to attempt to estimate the great value of his researches, so well are they known."

Through the courtesy of Mr. W. J. Hammer, the writer is enabled to give some further details relating to the visit of Prof. Ferraris in the United States. In a letter to his intimate friend, Signor Candellero, Prof. Ferraris said: "At New York I was received by Consulting Engineer William J. Hammer, who gave me four full days of his time, accompanying me everywhere and introducing me to a great number of men of science. With him I went to Llewellyn Park, where Edison has his residence, and where I was received with singular courtesy and distinction, and was conducted

R. MUSEO INDUSTRIALE ITALIANO
SCUOLA DI ELETTROTECNICA

Torino April 13th 1896

My Dear M. Hammer

As I have not jet received my apparatus, I am very anxious about them; and you would oblige me very much if you could let me know the name of the steamer on which they were shipped and the day of its sailing, in order to be able to make researches.

With my best salutations, Yours very truly

Galileo Ferraris

FIG. 3.—REPRODUCTION OF FERRARIS LETTER.

by Edison, in person, through his laboratory." Mr. Hammer was chairman of the World's Fair Committee of the American Institute of Electrical Engineers at Chicago in 1893, and secured from Prof. Ferraris the loan for exhibition at the Institute headquarters, of the apparatus with which the principle of the rotary field has been demonstrated. Shortly after having been notified that the apparatus was shipped, a cablegram was received from Prof. Ferraris saying that the steamer to which it had been consigned had sunk in the harbor of Genoa, and asking if the apparatus should be sent on if it were recovered. Mr. Hammer having cabled in reply an urgent request that the apparatus be forwarded, this was done and it formed perhaps the most interesting historical electrical exhibit at Chicago. There having been some delay in returning the apparatus owing to custom house regulations, Prof. Ferraris exhibited a solicitude natural in view of his previous experience. As a specimen of Prof. Ferraris' writing and his knowledge of the English language, a letter to Mr. Hammer on this subject is reproduced to accompany this article. Mr. Hammer relates that during the afternoon spent in the Edison laboratory at Orange, Mr. Edison asked, "Prof. Ferraris, how did you first conceive the idea of the rotary field principle?" With a laugh, Prof. Ferraris replied, "Oh, I guessed at it mathematically." He then explained his various experiments in polarized light, which he said led him to feel that certain of the fun-

damental principles of optics were also applicable to electromagnetism, and that he built his experimental models to demonstrate the correctness of this view.

The work of the sculptor, Contratti, the monument recently unveiled in Turin needs little description, the illustration reproduced here, showing clearly its nature. The artist has caught and reproduced in bronze the thoughtful face of Galileo Farraris. The statue is placed on a pedestal of marble at the base of which lies a large winged sphinx, on which a nude female figure reposes, representing physical truth seeking the mysteries of nature while listening to the mysterious voice.

At the two sides there are bas reliefs, hardly indicated in the illustration, recalling the first experiment in transmitting electrical energy from Lauffen to Frankfort, and the reception given by Edison on the occasion of his visit to America.

On the plate fastened to the base of the monument is written:

To
GALILEO FERRARIS,
From Admirers, Disciples, Friends.

Born in Livorno P., Oct. 30th, 1847.
Died in Torino, Feb. 7th, 1897.
The Admirable Discovery of
The Rotary Field
Opened to Science, to Industry, to Civilization.
New Paths.

This Proclaims the Glory
Of the Great Electrician.

The monument is about 22 ft. high. The jury for the choice of the prospective monument, composed of three well-known artists, Belli, Bistolfi and Reduzzi, complimented Contratti by choosing his project, and confirmed the promise which the young artist had given when he moved from his birthplace, Brescia, to Turin, and exhibited in the Exposition of Art, his first works: "Impressioni dal Vero" and "Il Vaso." Other well-known works of his are: "Bust of Napoleon," "Monument of Giacinto Pacchiotti," "Memorial to Brofferio."

Effect of Series Resistance in the Primary Circuit of a Transformer.

BY H. A. PIKLER.

IT is well known that if a sine wave e.m.f. is impressed upon the terminals of a transformer, the other side of which is open, the hysteresis loop, or more correctly, the change in the permeability in the iron during one cycle of magnetism, will distort the exciting current wave. In other words, if we want to get a sine-shaped e.m.f. wave at the terminals of the transformer, we have to excite it by a current, the wave form of which is correspondingly distorted.

The intention of this article is to show that by *sending a sine wave exciting current through the transformer we get the e.m.f. wave distorted.* This distorted e.m.f. wave will be of exactly the same shape as the distorted current wave in the former case, when the impressed e.m.f. wave was a sine curve.

On consideration it will be seen that the e.m.f. curve in this case has interchanged with the current curve. This is exactly what happens if we use a series resistance in the primary circuit of the transformer for controlling its terminal voltage.

In order to test electric apparatus for dielectric strength, almost all testing rooms or laboratories use the following equipment: A sine wave generator, a high-voltage step-up transformer, the low-voltage primary side of which has a series regulating resistance, generally a water rheostat.

A similar arrangement is sometimes used for measuring the core loss on transformers. That is, a sine wave generator and a variable series resistance in the circuit in order to obtain the desired voltage across the transformer terminals. See Fig. 1.

If we want to determine the core loss of a transformer, this should be measured at a sine-wave shaped e.m.f. curve, flat curves giving a considerably higher, peaked curves a lower, core loss at the same effective value of the curve; that is, at the same voltage measured at the terminals of the transformer by an ordinary voltmeter. If we test an electrical apparatus for dielectric strength, we assume that the tested material is subjected to a sine-wave e.m.f.; that is, the maximum potential is $\sqrt{2}$ times the effective value, indicated by the voltmeter. Now, using a series resistance in the transformer circuit, neither mentioned demands are fulfilled nor correct results derived.

The effect of the series resistance is to change the exciting-current wave form. The more the energy consumed by the ohmic series resistance comparatively to the energy consumed by hysteresis in the transformer, the less will be the distortion of the current wave, it will become more and more sinusoidal. But if the transformer gets a sinusoidal magnetizing current, its induced e.m.f. wave will be distorted; and assuming as a limit a perfect sine-wave shaped exciting current, the induced e.m.f. wave of the transformer will have exactly the same shape as the exciting-current curve has, when the current drawn from the sine-wave generator is only that due to the transformer, the secondary of which is open.

These statements are confirmed by experiments as shown in curves (Figs. 2 to 10). The testing arrangement is the same as shown in Fig. 1. The curves were taken with the aid of an oscillograph, and are here reproduced direct from the record.

Fig. 2 shows the e.m.f. wave form taken at the terminals of the generator, when it was excited to 80 volts effective terminal voltage. Fig. 3 shows at the same time the current wave in the circuit, its effective value being 25 amp. Fig. 4 shows at the same time the e.m.f. wave at the terminals of the transformer, the effective value being 55 volts. The core loss of the transformer measured at the same time 300 watts. The amount of the regulating ohmic resistance has not been measured.

Fig. 5 shows the e.m.f. curve at the terminals of the generator when excited to 182.5 volts effective pressure; more resistance has been

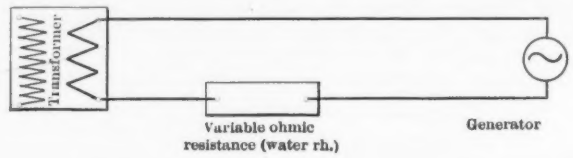


FIG. 1.—DIAGRAM OF CONNECTIONS

put in the circuit to obtain again the same volts at the transformer terminals. Fig. 6 shows the current wave, the effective value of which being now 16.8 amp. Fig. 7 shows the wave form of the transformer terminal voltage, its effective value being again 55 volts—core loss of the transformer 253 watts. Then the generator was excited to 225 volts, and still more resistance was put into the circuit in order to obtain again 55 volts at the terminals of the transformer.

Fig. 8 shows the wave shape of the generator voltage, Fig. 9 the wave shape of the current at the same time, the effective value of which went down now to 15.3 amp. Fig. 10 shows the e.m.f. wave at the terminals of the transformer, the effective value being again 55 volts as measured by a Weston voltmeter, the core loss being 238 watts.

It is not necessary to go further. If we compare the wave forms of the generator voltage in the three cases, we find that they are almost alike. The current curves, which are all to the same scale, are always less and less distorted when using more resistance in the circuit. The higher harmonics at the lowest value of resistance in the circuit are shown up in a marked manner by the increased exciting current, which is 25 amp., whereas at a higher resistance, as in Figs. 8, 9 and 10, they get weakened and the current consumed is only 15.3 amp.

The change in wave form at the terminals of the transformer is what interests us mostly. All three curves, Figs. 4, 7 and 10, are represented on one scale. Their effective value is the same, 55 volts. But their shape and their maximum is different. Fig. 4 is more symmetrical, nearer to a sine wave, comparatively flat. Fig. 7 is more peaked; note the assymetry in it. Fig. 10 is entirely distorted; it shows the tendency to take the shape of current curve, Fig. 1.

The maximum values of these three transformer e.m.f. curves are as 1: 1.105: 1.182. The table on next page gives a comparison of results.

From all these curves and results it follows: 1. When using series resistance in the primary circuit of a step-up transformer for controlling its terminal voltage in order to test electrical apparatus for *dielectric strength* by that transformer, the wave form of the applied voltage will get peaked, the maximum of the curve being

more than $\sqrt{2}$ effective. If we determine the testing high voltage by a voltmeter connected to the terminals of the transformer, the tested apparatus will get a higher *maximum* voltage than we assume. If we use an air-gap curve for determining the desired voltage, then the tested apparatus is subjected to a lower *effective* pressure than desired, because the break-down of the air-gap is rather due to the maximum pressure.

Generator voltage.	Transformer terminal voltage.	Current consumed by the circuit.	Watts (core loss) consumed by the transformer.	Comparative maximum of E.M.F. wave curve at the transformer terminals.	Comparative maximum of current wave curve.
80	55	25	300	1.	1.
182.5	55	16.8	253	1.105	.72
225	55	15.3	238	1.182	.656

2. When using a series resistance in the circuit of a sine-wave generator in order to control the voltage at the terminals of a transformer being tested for *core loss*, the e.m.f. wave form at the terminals of the transformer will be peaked, and the obtained core loss will be less than at an impressed sine-wave e.m.f. of the same effective value.

On this account the voltage on the transformer under test should not be controlled by a resistance in series, but the test transformer should be connected directly to the generator or to a step-down transformer whose primary is directly on an alternator of known wave shape; the necessary voltage control being obtained by controlling the alternator itself. If the step-down transformer employed is of good design, with low magnetizing current, the effect of its presence on the wave form will be negligible.

The form factor of the distorted e.m.f. curve at the transformer terminals depends upon the saturation of the iron and upon the completeness of restoration of the current wave due to the energy consumed by the series ohmic resistance.

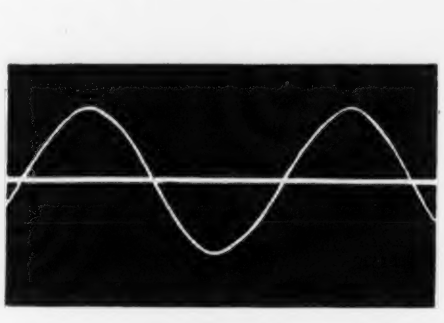


FIG. 2.

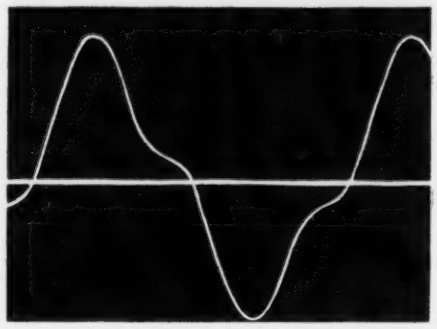


FIG. 3.

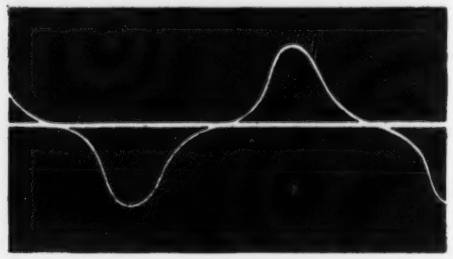


FIG. 4.

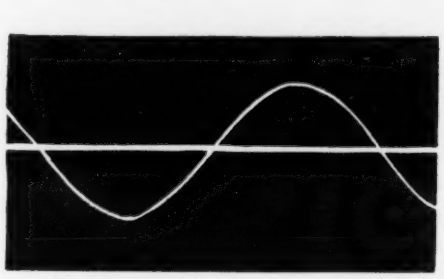


FIG. 5.

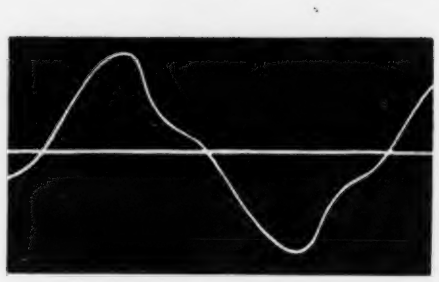


FIG. 6.

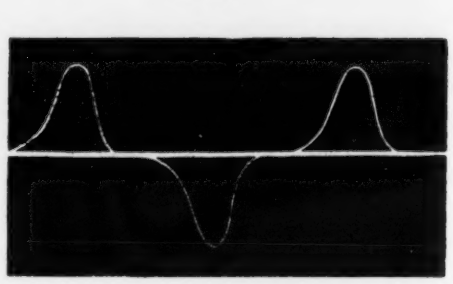


FIG. 7.

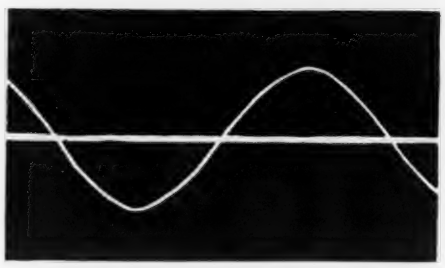


FIG. 8.

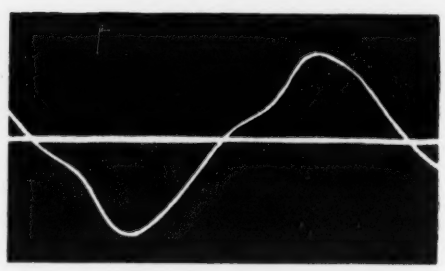


FIG. 9.

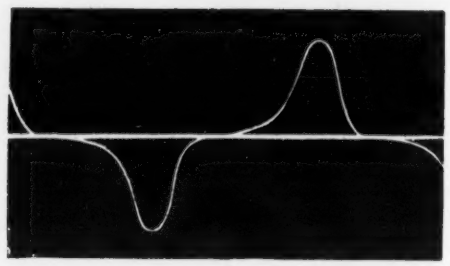


FIG. 10.

FIGS. 2 TO 10.—CURVES TAKEN BY MEANS OF AN OSCILLOGRAPH.

Plotting of Speed Time and Speed Distance Curves From the Acceleration Speed Curve.

BY L. A. FREUDENBERGER.

THE following article is a continuation of a communication on the plotting of speed-time curves from the tractive effort-speed curve, which appeared in the issue of July 18, 1903. A typical run between stations was taken, showing the effect of grades and curves and the speed-time curve constructed in conjunction with the speed-distance curve.

Having given the ordinary performance curves of a motor (the horizontal tractive effort and speed for different currents) the curve giving the relation between the horizontal tractive effort and the speed may be plotted. Subtracting from the horizontal tractive effort, at any speed, the train resistance at the same speed, will give the net tractive effort (expressed in pounds per ton), which will be available for accelerating the car. The value of the rate of acceleration will be $a = 0.01098\ f$, where a is the rate of acceleration in mi/hr seconds and f is the net tractive effort in pounds per ton. Thus the rate of acceleration (dv/dt) is known for different speed values (v).

$$\text{Since } a = \frac{dv}{dt}, \text{ then } dt = \frac{1}{a} \cdot dv.$$

$$\text{Also } v = \frac{ds}{dt}, \text{ then } ds = v \cdot dt, \text{ or } ds = v \cdot \frac{1}{a} \cdot dv = \frac{v}{a} \cdot dv.$$

$$\text{Therefore, } \int dt = \int \frac{1}{a} \cdot dv, \text{ or } t = \int \frac{1}{a} dv \qquad (1)$$

$$\int ds = \int \frac{v}{a} \cdot dv, \text{ or } s = \int \frac{v}{a} \cdot dv \qquad (2)$$

From (1), if values of $1/a$ are plotted on a speed base, the area included between the curve and the speed base will represent time values corresponding to different speeds. From (2), if values of v/a are plotted on a speed base, the area included between the curve and the speed base will represent distance values corresponding to different speeds. Values of $1/a$ and v/a may easily be obtained by means of the ordinary slide rule.

Fig. 5 gives rates of acceleration for different speeds. Curve *M* represents gross rates of acceleration and to a different scale of ordinates will represent gross tractive effort (in pounds per ton) for various speeds. Curve *R* similarly represents train resistance (during acceleration). Curve *N* is obtained by subtracting ordinates of curve *R* from ordinates of curve *M*. Curve *Q* similarly represents train resistance (while drifting) and includes the effect of the friction of the gears and bearing. Curve *B* represents negative rates of acceleration while braking. The accompanying table gives the data upon which the curves are constructed:

Portion of run.	Length in miles.	Total length in miles.	Per cent. of grade. Up grade.	Per cent. of grade. Down grade.	Track curvature in degrees.	Net equivalent acceleration in mi. hr. sec.
O-A	0.107	0.107	0.540		4°	0.158
A-B	0.347	0.454	0.900		tangent	0.198
B-C	0.521	0.975		0.364	tangent	0.080
C-E	0.567	1.542	0.433		tangent	0.095
E-G	0.183	1.725		0.122	tangent	0.027
G-H	0.065	1.790		0.302	2°	0.046
H-I	0.063	1.853		0.122	tangent	0.027

Curves *M*, *R*, *N* and *Q* were taken from Fig. 9, page 1060, of "Notes on the Plotting of Speed Time Curves," by C. O. Mailloux, *Transactions* of the A. I. E. E., Vol. XIX. The braking curve was derived from Fig. 3, page 1040, of the same article. This curve was expressed as an equation of the form, $t = 10.35 - 0.986\ v + 0.02016\ v^2$, where t represents time in seconds and v the velocity in mi/hr. The equation becomes $t^1 = 82.05 - 2.5988\ v^1 + 0.02016\ v_1{}^2$. $v = v^1 - 40$. That is, the speed ordinates were increased by 40 mi/hr. The equation becomes $t^1 = 82.05 - 2.5988\ v^1 + 0.02016\ v^{1\,2}$ Differentiating with respect to time (t), we have

$$1 = -2.5988 \frac{dv}{dt} + 0.04032\ v \cdot \frac{dv}{dt},$$

$$\text{or } \frac{dv}{dt} = a = \frac{1}{0.04032\ v - 2.5988}$$

The braking curve, *B*, Fig. 5, would, of course, in actual practice, be replaced by a braking curve obtained experimentally. No other braking curve at high speeds was available, however, and the braking curve was used to illustrate the principles outlined above.

A concrete case was taken (the data being given on Fig. 5) and the speed time and speed distance curve plotted. The run is substantially the same as service run No. 7 of Mr. Mailloux's paper, except that some of the grades were changed.

The method of plotting the speed distance curve is shown by Fig. 1 and Fig. 2. Fig. 2 is construsted by taking values of the rate of acceleration (a) at different speeds from Fig. 5. The value of v/a is then known for that speed and may be plotted as the curve in Fig. 2. The area included between the speed base and the curve

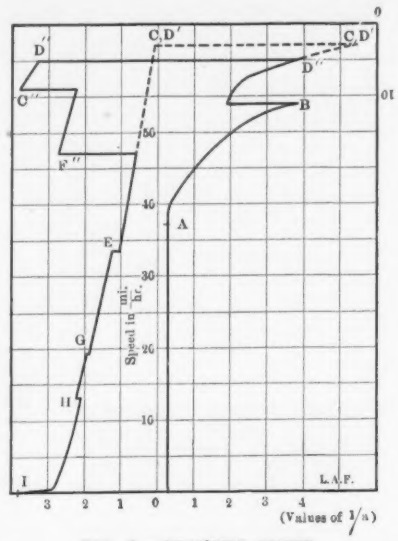
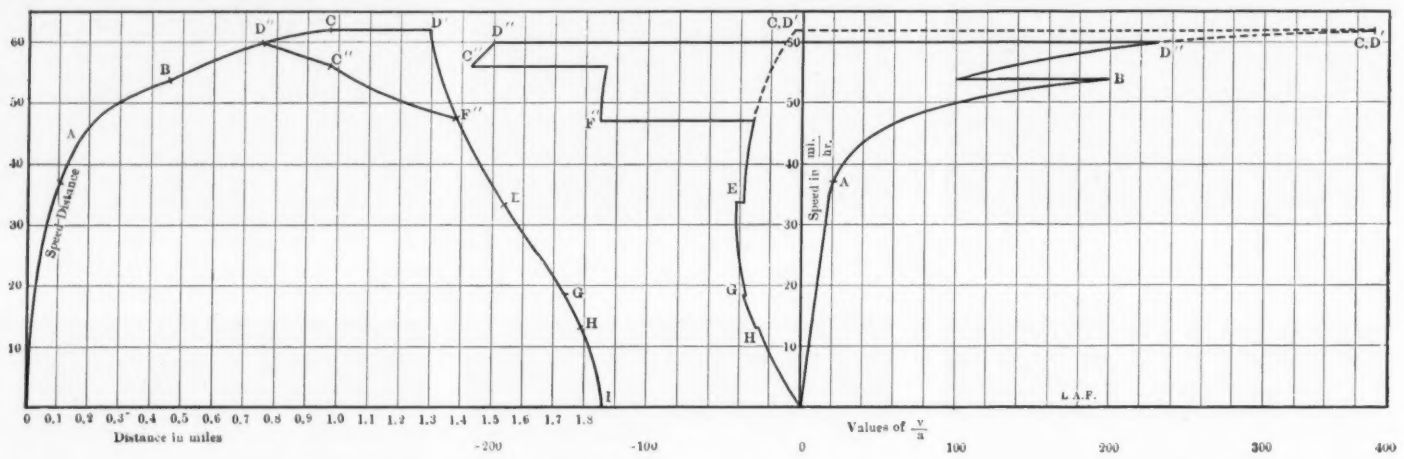


FIG. 3.—BRAKING CURVE.

(Fig. 2) will represent distance values corresponding to the different speeds. The curve is cut off at *A* (Fig. 2), corresponding to a distance of 0.107 mi. The speed value at a distance of 0.107 mi is 37.25 mi/hr. At *A*, for instance, the net traction would be (curve *N*) 2.049 mi/hr sec. This traction is diminished by an up-grade of 0.540 per cent. and a 4° curve to 2.049 — 0.158 = 1.891 mi/hr sec. The value of v/a would be 19.7 and would be plotted as the abscissæ



FIGS. 1 AND 2.—CURVES OF SPEED DISTANCE.

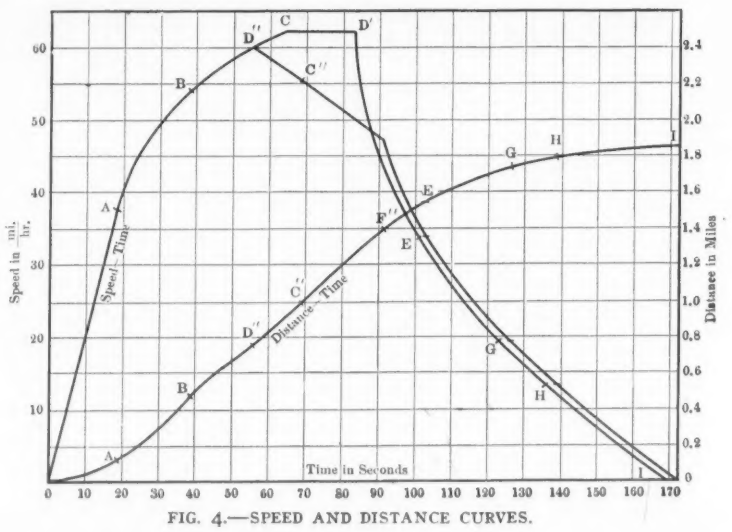
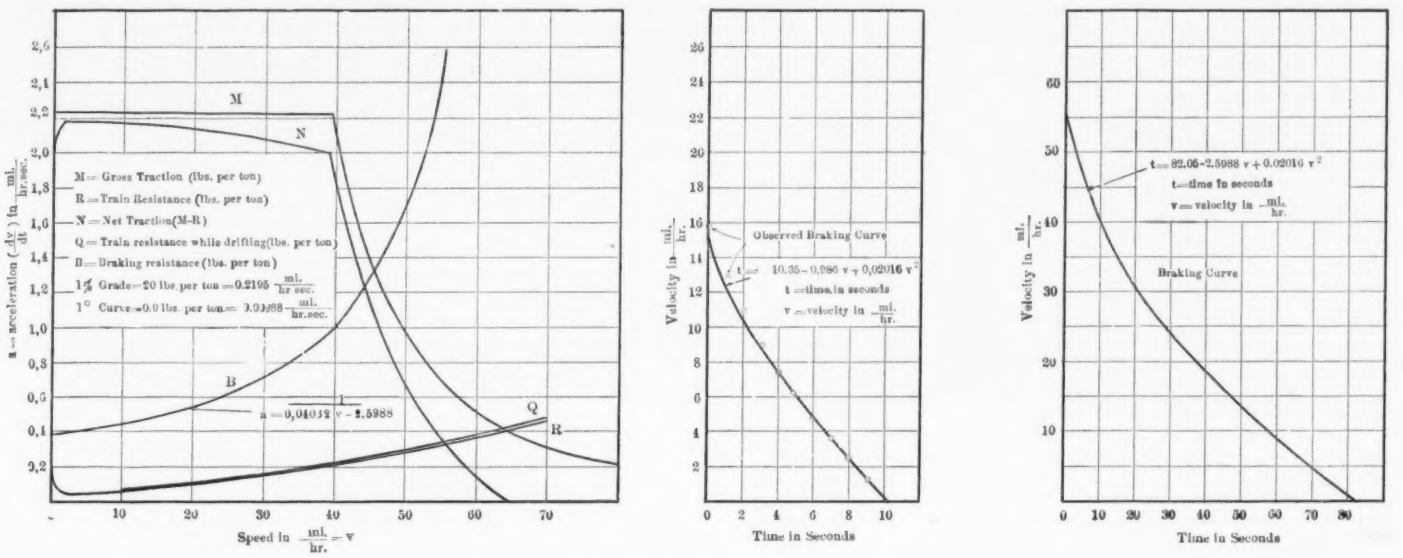


FIG. 4.—SPEED AND DISTANCE CURVES.

at the point *A*, Fig. 2. From *A* to *B* the grade changes from an up-grade of 0.540 to an up-grade of 0.900 per cent. without any curve.

The rate of acceleration (at a speed of 37.25 mi/hr) would be 2.049 — 0.198 = 1.851 mi/ hr sec. The value of v/a would be 20.13, so that there is an abrupt change in v/a at the point A due to a change in grade. This is seen better at the point B (distance of 0.454 mi). The points B and C are determined in a manner similar to A.

At C (speed 62.25 mi/hr) the net traction is approximately balanced by an up-grade of 0.433 per cent., and the speed remains constant at 62.25 mi/hr. It becomes necessary at this point to anticipate braking, and the speed distance curve is started from the end of the run (distance of 1.853 mi), until it cuts the line $C\,D'$ at the point D'. Such a run would consist of an acceleration cycle from O to D' and at D' the brakes would be immediately applied. This would give the minimum time of making the run, but the energy consumption would be a maximum. In practice the car would be allowed to "drift" during a portion of the run before the brakes were applied, thus increasing slightly the time required to make the run, but decreasing the energy required to make the run, and giving the motorman a chance to make up lost time by continuing the acceleration up to the point D' and then immediately applying the brakes. It is evident that the drifting portion may be made anything we please. For we might start the drifting run from the end of the run (1.853 mi), intersecting the acceleration curve somewhere near the point A, Fig. 1. This would give a minimum consumption of energy, but the time required to make the run would be so great as to be entirelv


M
N
M = Gross Traction (lbs. per ton)
R = Train Resistance (lbs. per ton)
N = Net Traction (M-R)
Q = Train resistance while drifting (lbs. per ton)
B = Braking resistance (lbs. per ton)
1% Grade = 20 lbs. per ton = 0.2195 mi./hr sec.
1° Curve = 0.01 lbs. per ton = 0.01098 mi./hr.sec.
B
Q
R
Speed in mi./hr. = v
Observed Braking Curve
t = time in seconds
v = velocity in mi./hr.
Braking Curve
Time in Seconds

FIGS. 5, 6 AND 7.—BRAKING CURVES.

out of the question. Usually for express service very little time can be allowed for drifting. If the car starts drifting from the point C, Fig. 2, the time required to cover the distance will be increased by only 0.12 sec.

The drifting curve was started from the point D'' (speed 60 mi/hr), thus increasing the time required to make the run by only 2.8 sec.

The speeds corresponding to the points A, B, C'', D'', F'', E, G and H, having been determined from the speed distance curve, the speed time curve may be plotted from Fig. 3. This integration may be performed (as also in deriving the speed distance curve, Fig. 1 from Fig. 2) by means of a planimeter, point by point, or better, by means of an integraph, giving the integral curve directly. For instance, the area included between the speed base (Fig. 3) and the curve from O to A (Fig. 3) will represent a time value of 18.6 sec., and is plotted at A (Fig 4). The speed time curve and speed distance curve would usually be plotted together. The time required to go from C to D' cannot be determined from the line $C\,D'\,C\,D'$, Fig. 3, since the speed is constant. It can, however, be easily obtained from the speed distance curve, Fig. 1. The distance from C to D' is 0.319 miles, at a speed of 62.25 mi/hr will require

$$\frac{0.319}{62.25 \times 3600} = 18.45 \text{ seconds.}$$

The points A, B, D'', C'', F'', G and H, are known from the speed values on Fig. 1.

The distance time curve is plotted from the speed time and speed distance curves. For instance, a speed of 50 mi/hr corresponds to a distance of 0.284 miles (Fig. 1) and a time of 31.1 seconds (Fig. 4).

The author desires to acknowledge his indebtedness to Mr. Mailloux for many valuable practical suggestions while prosecuting the above investigation.

The Associazione Elettrotecnica Italiana Excursion to the United States in 1904.

The general council of the above-named association, at its meeting on April 26, approved the suggestion of the president to organize an excursion of the association to the United States in September, 1904, on the occasion of the Exposition and the International Congress of St. Louis. The president, Prof. M. Ascoli, having personally consulted a number of members, has already received a sufficient number of acceptances to secure the success of the proposed trip. The excursion will take about 50 days and the itinerary will be approximately as follows: Genova and Naples, New York, Boston, Niagara, Chicago, St. Louis, Pittsburg, Baltimore, Washington, Philadelphia, New York. Departure is fixed for about the middle of August.

In consideration of the importance of the trip, Prof. Ascoli has requested those who intend to take part to give him prompt notice, without assuming definite obligations, as it is necessary to know the approximate number of those taking part in order to prepare an exact estimate of the cost of the trip. It is expected that the cost, including everything, will not exceed 1,700 francs per person; but this estimate may be reduced when it is possible to decide upon a definite programme with the assistance of their American colleagues and of the committees of the Exposition of St. Louis.

Only members of the Associazione Elettrotecnica Italiana and their ladies will be allowed to join the party. The entire sum which is necessary for the trip must be paid to the cashier of the Associazione Elettrotecnica Italiana at least one month in advance of the day which will be fixed for the departure. Any sums deposited with the cashier will be returned in case the member cannot accompany the party or in case the excursion does not take place. It is certain that our Italian friends will receive a warm welcome on their arrival, and it may be hoped that a large party will come.

Electrical Manganese Works.

Final arrangements have been completed for the establishment of electrical manganese works at Shawinigan Falls, Que., by the Electrical Manganese Company, of which Mr. B. E. Kingman, of New York, is the president. The company has secured some twelve acres of land on the line of the Great Northern Railway, at Shawinigan, and has contracted with the Shawinigan Water & Power Company for the delivery of 5,000 hp. According to contract, about 1,200 hp is to be delivered the Manganese company for its plant by August 15. It is the intention of the company to enter, at a later date, upon the manufacture of different kinds of steel, and it is on this account that such a large contract for electric power has been made. This is the first electrical manganese plant to be erected in Canada.

Telephone Exchanges.—VII.

By Arthur V. Abbott, C. E.

POLE PIECES AND DIAPHRAGM.

MATERIAL for pole pieces and the diaphragm should possess diametrically opposite magnetic qualities to those described for permanent magnetic. Formerly the softest and best annealed charcoal iron has been found the best material for the purpose, as it possesses the great permeability and small coercive force.

In Fig. 13 a $\mathfrak{B} - \mathfrak{H}$ curve is given for sheet steel and for ferrotype metal. The latter has in the past been almost exclusively used for diaphragms, and while it shows a very high ultimate permeability with intense fields ($\mathfrak{H} = 30$), it is less sensitive than soft iron or sheet steel. Further, its hysteretic losses are considerable, and its coercive force high. In these respects sheet steel shows itself the peer of any metal save some of the more unusual iron alloys. But with improved metallurgical processes other alloys of iron showing themselves to be superior to the older charcoal brands. Thus the researches of Barrett, brown and Natfield show irons containing 2½ per cent. of silicon, and 2¼ per cent. of aluminum, that are respectively 33 per cent. and 45 per cent. more permeable than the best of charcoal irons. The magnetic characteristics of these alloys compared to charcoal iron are shown in Fig. 22, while table V exhibits additional tests of some such alloys as compared with the best annealed Swedish iron. The sample 898E by analysis gave iron,

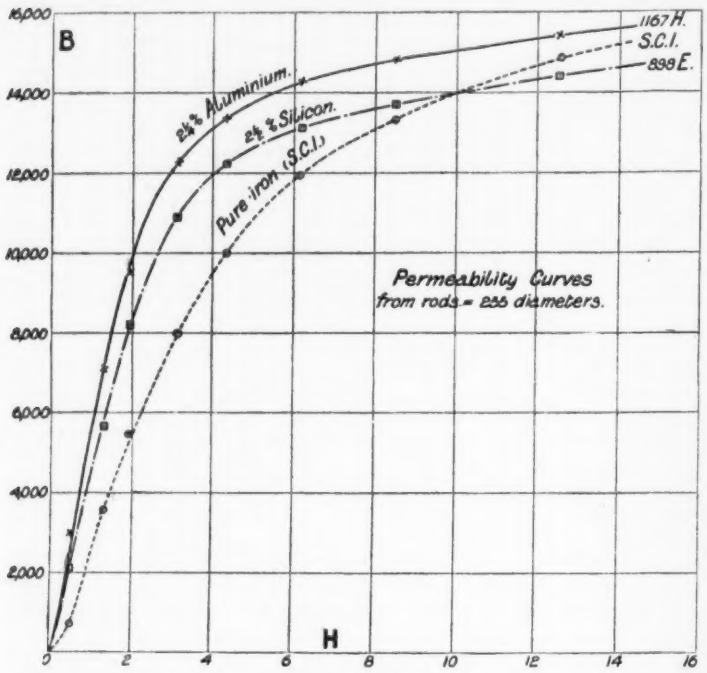


FIG. 22.—CURVES FOR SPECIAL IRONS.

97.3 per cent.; silicon, 2.50 per cent. No. 1178H had a composition of iron, 97.33 per cent.; carbon, .24 per cent.; aluminum, 2.25 per cent.; silicon, .18 per cent.

TABLE V.
Magnetic Qualities of Silicon and Aluminum Irons.

H	Charcoal iron.		898 E Silicon iron.		1167 H Aluminum iron.	
	B	w	B	w	B	w
2	7,400	3,700	10,200	5,100	12,000	6,000
4	11,150	2,790	12,300	3,075	13,800	3,450
6	12,600	2,100	13,400	2,233	14,500	2,416
8	13,600	1,700	13,800	1,725	14,900	1,862
10	14,300	14,300	14,200	1,420	15,200	1,520

It appears well worth the while for receiver manufacturers to secure samples of such alloys and see whether some improvement in receiver construction could not be accomplished by their employment for diaphragm and pole pieces. Finally to avoid the eddy currents which are inevitably set up whenever a change in magnetic field occurs, it is from a theoretical standpoint advisable to laminate thoroughly the permanent magnets, the pole pieces and the coil spools (if constructed of metal). That this refinement would undoubtedly add considerably to the cost of the receivers, is unquestioned, and whether the "game would be worth the candle" can only be determined by experiment. But it is certainly a move in the right direction, and the time is rapidly approaching when in all departments of telephony it will not be the *cheapest apparatus*, but the *best apparatus* which will alone be tolerated, and it is only those who are foresighted enough to see that the best is always in the end the cheapest, who will be able to survive in the competition which daily grows more and more fierce.

One of the best methods for investigating the magnetic properties

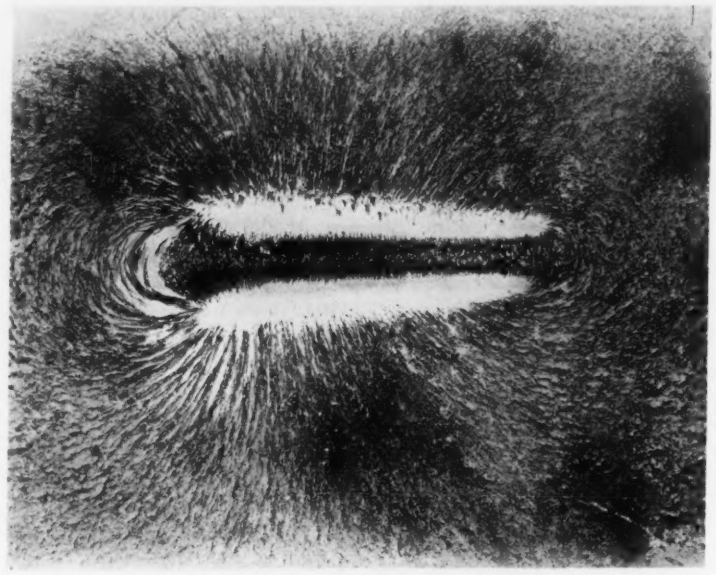


FIG. 23.—RECEIVER PHANTOM; POLE PIECES DETACHED.

of a telephone receiver system is to examine the field by means of iron filings, making a so-called *phantom*. Such a picture of the magnetic field only indicates the distribution of the flux in one plane, and by no means can be considered an accurate quantitative measure of the magnetic system, but if some precautions are observed the relative fields of two instruments may be compared with consider-

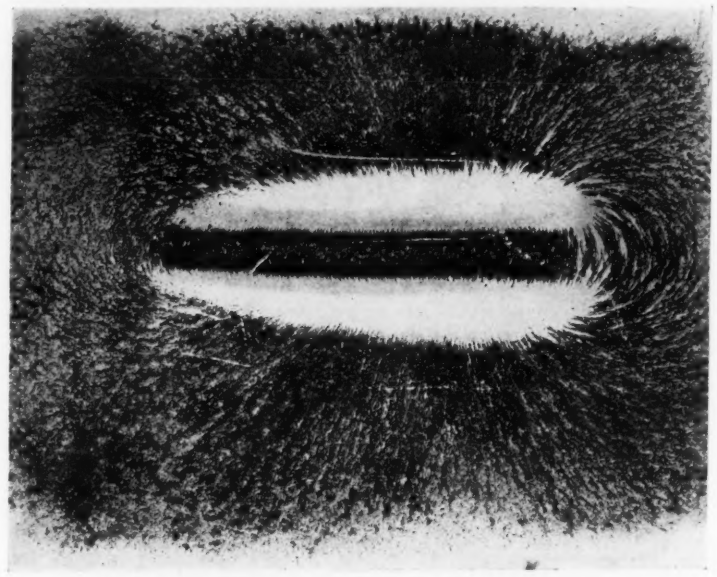


FIG. 24.—RECEIVER PHANTOM; POLE PIECES IN PLACE.

able accuracy. It is best to prepare the iron filings by sifting them through two sieves of nearly the same sized mesh; for example, one sieve of No. 40 and one of No. 50, namely 1,600 meshes and 2,500 meshes per square inch, accepting for the purpose only those filings which are retained by No. 40 sieve and passed by No. 50 sieve. A definite amount of filings, measured preferably by weighing, should be selected, and the same quantity used for each test. This quantity of filings should be carefully and evenly distributed over a photographic plate by sifting them through a slightly coarser sieve, say No. 35. In this way each plate used is uniformly covered with amost exactly the same number of filings and consequently the density of the filings per unit area is about the same in all cases.

The best plate for the purpose is a celluloid film, because it is much thinner than the ordinary glass plate. After the filings are properly deposited on the celluloid it should be gently laid in proximity to the magnet under investigation and tapped. In each case the same number of blows of the same intensity should be given in order that equal liberty shall be given to the filings to arrange themselves in the field. For this purpose an electric bell, provided with a heavily weighed clapper, to retard its motion, is an excellent device. Some results by this method of study of the magnetic system of a receiver is shown in Figs. 23, 24 and 25. The receiver selected for the purpose was a Stromberg-Carlson.

In Fig. 23 the field of the permanent magnet is shown with the pole pieces detached. Here the fanning out of the lines of force across a gap usually occupied by pole pieces is conspicuously shown. In Fig. 24 the pole pieces occupy their normal position. A noticeable change in the field is shown as it is denser, with fewer leakage lines between the limbs of the magnet and the leakage across the gap pole pieces is less marked. In Fig. 25 the diaphragm has been put in place and here the change in the field is exceedingly conspicuous. The leakage across the poles is much reduced. The field around the magnet bar is very much higher and the lines of force in the surrounding field markedly reduced. In this way a valuable analyses of the behavior of the magnetic systems

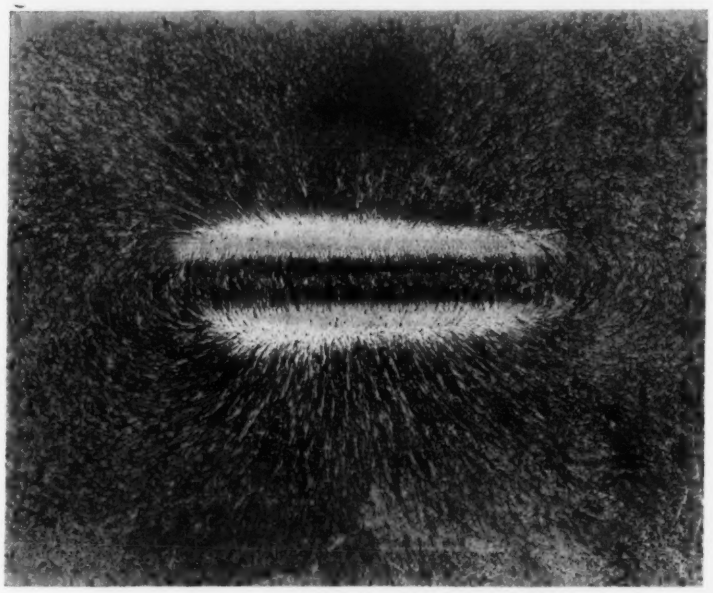


FIG. 25.—RECEIVER PHANTOM; DIAPHRAGM IN PLACE.

of receivers may be obtained and estimates formed as to the relative proportions of the magnet, the pole pieces and the diaphragm, and by making a series of such diagrams of a number of such instruments valuable deductions may be drawn as to the relative desirability of the various designs employed.

Storage Battery Efficiency.

In a supplementary communication in discussion of the Niagara paper presented by Mr. Frank L. Sessions on storage battery locomotives, Mr. Edgar H. Berry states he has taken up the question of battery efficiencies at different discharge rates with a well-known company which has had a wide experience in the manufacture and maintenance of storage batteries, and whose records contain a considerable fund of information in regard to the actual performance of their cells. This company states that "Assuming the efficiency of 75 per cent. for the 8-hour charge and discharge rates to be correct, the amount of energy required to re-charge after a discharge at the 5, 3 and 1-hour rate, would be exactly proportionate to the amount taken out—so long as the charging was done at the normal rate."

Mr. Berry says that on this basis all the figures in a table in Mr. Sessions's paper, excepting those applying to the 8-hour rate, should be eliminated, and the figures for the 8-hour rate should be taken as applying to the one-hour and all other rates considered. He does not for a moment wish to advocate the deliberate selection of a high discharge rate, but he does insist that the objections to such a course do not arise from an increase in the watt-hours per unit of work, necessary for charging. The penalties imposed by a high discharge rate are similar to those incurred when any piece of apparatus is worked very near its ultimate limit of endurance. A high discharge rate means a low factor of capacity, and a considerable increase in the risk of injury to the plates when handled by unskilled persons. These are the considerations that must be set against the increased cost of the larger battery, in determining the proper size to give the highest ultimate commercial efficiency.

Burnett Luminometer.

In response to the need of an instrument for measuring illuminators as contrasted with intensity of source, a number of devices have been proposed. One of these, the luminometer of Messrs. Houston and Kennelly, consists of a movable screen cut-off to various degrees, the light entering a box through a translucent glass and illuminating some printed characters. The measure of the lighting is indicated by the point at which the characters became blurred and indistinct. More recently Mr. W. D. A. Ryan has brought out a somewhat similar instrument; the observer carries the device away from the lamp which is the source of the light, until printed characters become blurred and indistinct, and at that point the illumination is said to reach the minimum serviceable amount. This latter instrument, therefore, does not in any way define the amount or variation of the illumination, but merely defines the limit of the useful area. It is chiefly useful in determining the area or distance illuminated by a lamp in street lighting, and is not suitable for measuring the amount of interior illumination.

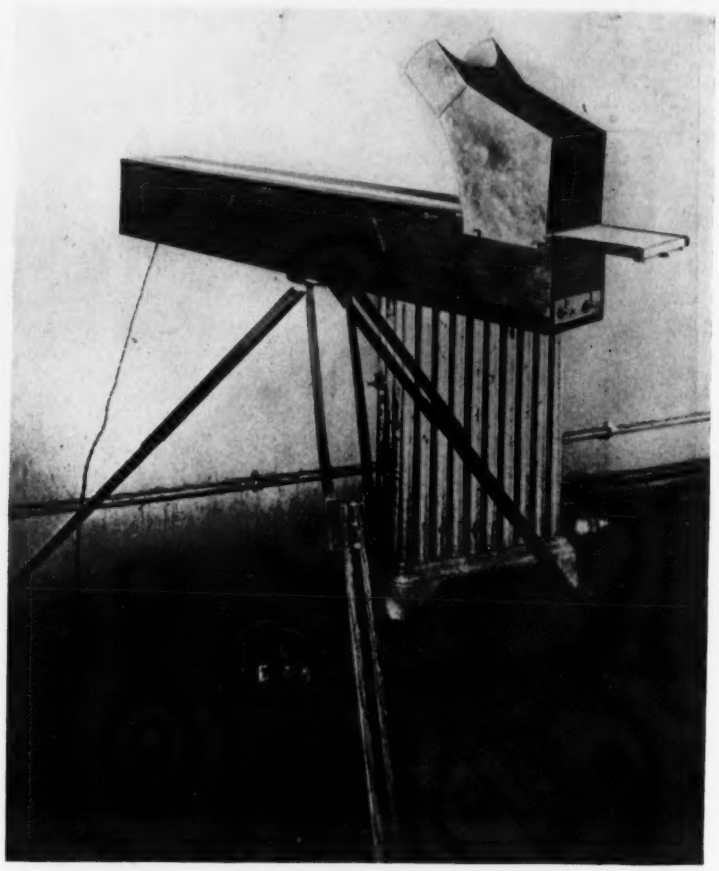


FIG. 1.—LUMINOMETER.

The device shown herewith is the invention of Mr. Douglass Burnett, and is designed to furnish a simple method of defining the amount of illumination at any point, in either direct sunlight, or artificial light, or where there is merely diffused light. It is based on scientific principles, is claimed to secure results with at least commercial accuracy, and works with the eye in its normal condition and without any change or adjustment of the light by means of mirrors or lenses.

A white surface is exposed to the light of a room, for instance, and is viewed by the observer, who also views at the same time a similar surface (Ritchie wedge) within the box or tube, the second surface being illuminated by a standardized lamp. The illumination on the shielded screen is made equal to the illumination on the ex-

posed surface, by moving the lamp towards or away from it. The result expressed in candle-feet is measured by the candle-power of the lamp divided by the square of its distance from the illuminated screen, the necessary correction faction being introduced to account for any reflection from the interior blackened walls of the instrument. In the particular apparatus shown in the illustrations, the range is from 10.0 candle-feet, with a 6-cp. lamp, to 0.10 can-

FIG. 2.—LUMINOMETER.

dle-feet with a 1-cp. lamp, a special thick filament lamp having been secured as a portable standard.

Just as a surveyor prepares a topographical map showing surface contour lines, it is expected that with this portable device a map or chart may be prepared showing the distribution of natural or artificial lighting, or both, in any room or open space, by means of illumination contour or "isophotal" lines. Data of this kind should be of the greatest importance in defining what are the actual conditions of illumination, and in assisting central station companies, for instance, to maintain lighting conditions at certain standards.

The Mercury Vapor Lamp in Photography.

In spite of the disagreeable color of the mercury vapor light, it has been found very effective in quick and clean-cut photography; and as our pages have already proved, excellent portraits can be taken with its aid. One of the best pictures of Lord Kelvin, for example, was that which we reproduced recently from a photograph of himself, taken in London with Mr. George Westinghouse, by means of a Cooper Hewitt lamp.

In New York City one of the artistic and original photographers of the new school, Mr. Pirie Macdonald, has been experimenting lately with the same lamp, in his studio on lower Broadway, and some of the photographs he has secured are among the most striking of his successes. It would be hard to characterize exactly the special quality of the new work, but it is the fact that in all the examples we have inspected, the values are admirable, involving a softness that is extraordinary when one recalls the harsh yellow-green of the mercury arc.

Mr. Macdonald uses three of the tubes. He has no "top light" in his studio, securing his light from two large north windows side by side. In the jamb separating these windows is his light. The three tubes take 114 volts and 2.8 amp. He estimates the combined power of light at 750 candles.

"I believe I am the first photographer to use this lamp," said Mr. Macdonald. "A bright, glaring light does not give any delicate modeling on faces, and that tone quality is what I am after. My best light here is about 11 o'clock. After that the smoke of the city closes in and it is all over. Unfortunately, I work with the men, who cannot all happen in here at 11 o'clock. Even if they did, I could not handle more than one of them in the hour of good light. They like to get here about 4 o'clock, and then I have all kinds of difficulty in getting the light I want, and my lengths of exposure stretch out to eight and ten seconds, when it ought to be two and four. I needed something to help out my daylight, and I have found it in the Cooper Hewitt lamp. At 11 o'clock I need no extra light. At 2 o'clock I turn on one tube and bring the quality of my light back to 11 o'clock. At 4 o'clock I turn on another tube and am again back to 11 o'clock, and at 6 o'clock I use the third tube and my light all night is equal to 11 o'clock A. M. light. With it I have to expose only the short time that I desire and by turning it off and on can control the amount of light with the same accuracy as I may my chemicals used later in developing my plates. For artistic portrait work it is all that I can desire; it is ideal. It is so soft that it does not affect the expression of the face and yet so powerful actually that it is equal to daylight. It is an epoch-maker.

"The ordinary electric light, incandescent or arc, is apt to be unstable, and it is hard. The flashlight is too gross to be considered. The field of this new light is broad. It can be used to illuminate theatres because the tubes can be protected for transportation by being placed in boxes, and all you have to do is to attach the electric wires to have your lamps working. We have sufficient light in the flash lamp for all practical purposes in theatrical work, but heretofore we have not had a single light which would aid the artistic photograph. No one knows exactly what the exact property of the light is. I know that it has no red rays in it and that it reduces the image on the ground glass to a black and white, so that I can form beforehand an accurate judgment of the resultant monochrome. As the light is constant in quality and quantity it is a simple matter to standardize the exposure and to control that most difficult thing called 'texture.'

"In portraiture texture is as individual as form, and until now the most expert photographers have been able only to suggest variety in complexional texture because of the changing light. If one uses the lamp alone without daylight there is possible the steady lighting of Rembrandt or the soft, mellow handling of Reynolds without destroying the characteristic pose, because the light and not the sitter is moved."

Recent Electrochemical Developments.

MANUFACTURE OF LEAD PEROXIDE.

A patent for the direct conversion of lead oxide litharge, red lead, etc., into lead peroxide was granted on July 28 to Mr. E. Quedenfeldt, of Duisburg, Germany, assignor to the Chemische Fabrik Griesheim-Elektron. He forms an emulsion of lead oxide with a concentrated solution of an alkali chloride, and electrolyzes the mixture, which is held in constant motion, at about three volts, with an inert anode of platinum or carbon, and a cathode of any metal, separated from the anode by a diaphragm. A brisk disengagement of hydrogen takes place at the cathode without any appreciable deposit of spongy lead. No trace of chlorine is evolved at the anode. The lead oxide, which is kept in constant motion, becomes gradually brown and toward the end of the process turns black-brown. The conversion to peroxide is said to take place quantitatively.

MERCURY CATHODE CELL FOR THE ELECTROLYSIS OF SODIUM CHLORIDE.

The different commercial types of cell employing a mercury cathode in the electrolysis of sodium chloride, are in general intended to give chlorine and caustic soda. In a patent granted July 28, Messrs. Chas. E. Baker and A. W. Burwell, of Cleveland, Ohio, propose to use a mercury cathode cell for the production of metallic sodium. The sodium amalgam, produced in the electrolytic cell at the cathode, is delivered to a retort which is heated to a temperature sufficient to volatilize the mercury but not the sodium. The mercury vapor is delivered to a condenser to be liquefied and returned to the electrolytic cell. The sodium remaining in the retort is removed by an outlet at the bottom.

BASKET FOR HOLDING TIN SCRAPS.

A patent was granted on July 28 to Messrs. M. Laernoes and J. Dunn, of Streator, Ill., for a basket for holding tin scraps, for use in the electrolytic recovery of tin from scraps. The purpose is to construct the basket so that the fuses can be renewed with great facility and to render the basket in general more durable. The basket is made of perforated sheet iron or steel with reinforcing angle irons at the corners, which are extended in the shape of yokes over the side walls of the basket and provided with laterally extending handles. One handle serves as the conductor for the current, and is bolted to the yoke-shaped angle iron, but separated therefrom by means of layers of tin or tin foil, which are interposed between the shank of the handle and the yoke-shaped iron, and which act as fuses.

BATTERY INVENTIONS.

A number of patents have recently been granted relating to storage batteries and primary batteries. Mr. Ralph N. Chamberlain, of Depew, N. Y., assignor to the Gould Storage Battery Company, patents a construction specially adapted for a storage battery which has to give a high potential but comparatively small current. For such a purpose the capacity for high discharge rate is of comparatively small advantage; what is wanted is a construction of cell which enables one to assemble a great number of cells in series with a minimum of trouble; the cells should also be as much as possible free from liability to injury by buckling or short-circuiting. For this purpose the inventor provides the vessel with a rib dividing its lower portion into separate pockets; electrode plates of opposite polarity are arranged in these pockets, which are of a character to catch and retain material dropping from the plates.

An invention of the late S. A. Rosenthal, of Waltham Cross, England, consists in the use of urea sulphate as a binding agent for the active material of electric accumulator plates where finely-reduced oxides of lead—such as litharge, minium or red lead, but preferably litharge—are used.

Mr. Louis Chronik, of New York City, assignor to the United States Battery Company, of Brooklyn, patents an improvement of the form of battery in which the secondary element is formed of a number of corrugated lead plates firmly clamped at right angles around a central vertical pillar or stem. The inventor also proposes an element formed of a plurality of plates having a stem or pillar cast in suitable openings in the plates. The same inventor patents a form of connection between storage battery plates and external conductors, which is essentially a binding post construction with a brass screw and socket embedded in non-corrodible lead, to protect the screw and socket from corrosion.

Mr. L. A. Lammerts, of Rotterdam, Netherlands, patents a detail of construction of small portable accumulators which are carried in the pocket or fixed to bicycles in connection with an incandescent lamp. The electrodes and pole terminals are usually connected by straight wires, passing through a chamber, into the lower part of which insulating material is cast, while the upper part, from which atmospheric air is shut out by a lid or cover, contains a gas intercepting device. With such a construction the connecting wires are liable to relatively rapid destruction, as the joint between them and the sealing mass is not sufficiently tight to prevent moisture from attacking the wires. The inventor, therefore, forms these wires in the shape of cylindrically-coiled helical springs, which is claimed to insure a tight fitting.

Mr. Joseph Appleton, of the Electric Storage Battery Company, of Philadelphia, patents an improved end cell switch suitable for adding to or cutting out from a circuit any desired number of cells without interfering with the operation of the circuit. The most efficient place for operating such a switch is at the switchboard; for this reason the inventor provides a suitable driving motor for the switch and means for controlling the action of the motor from a distant point, such as the switchboard. The motor may be run with current from the batteries themselves. The conductors which furnish the current to the motor include a make-and-break device situated at the switchboard, and the inventor also locates there a reversing switch in order to change the direction of the current in the armature so that the switch may be moved in either direction desired. The patent specification is very voluminous and is accompanied by no less than 32 sheets of illustrations.

Messrs. C. T. Richmond and M. H. Moffett, of Cleveland, Ohio, patent certain details of construction of a galvanic cell with a cylindrical zinc electrode, and an inner carbon electrode in the form of a hollow cylinder having external longitudinal grooves.

Mr. H. Csanyi, of Felsoe-Dobsza, Hungary, patents a primary cell, of which one electrode is of carbon immersed in nitric acid of 40° to 50° Baume, and the other electrode of zinc in an alcoholic solution of 5° to 15° Baume of pernitrate of mercury and potassium cyanide. A porous diaphragm is, of course, provided.

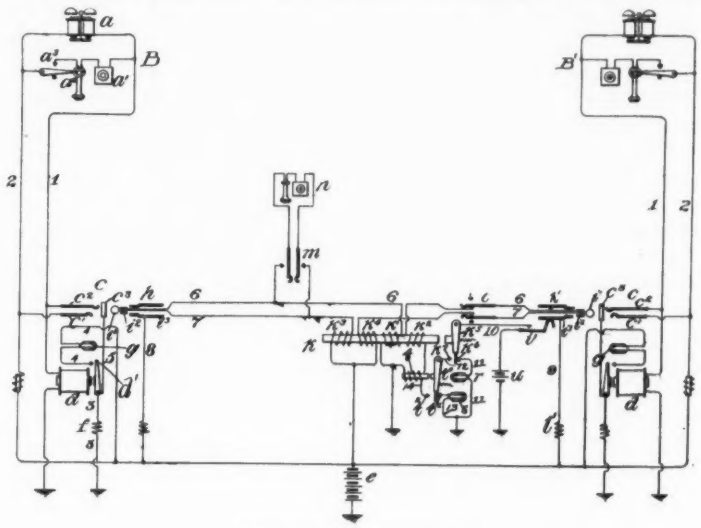
New Telephone Patents.

SUPERVISING CIRCUIT.

In large telephone exchanges it is a matter of great simplicity to provide means for secretly supervising the various operators to ascertain their efficiency. With small exchanges, where during a large part of the time the chief or manager in authority must be absent from the immediate premises, this is not so easy a matter. An apparatus and circuit for this purpose, designed for use at the residence of the manager and as an attachment to his regular telephone line, is the subject of a patent issued to W. W. Woodruff, of Winchester, Ky. With this system, an auxiliary induction coil is wired in the circuit of each operator to be supervised, the secondary winding of which is connected to contact points of a selector switch. The sweep contacts of this switch are wired directly to the chief's telephone line. The selector switch is under the control of the chief through the agency of a contact button connected in a pair of auxiliary wires extending to his premises, and an electromagnet operating a pawl and ratchet. Between each two working contacts upon the selector, intermediate dead points are left, that by one push of the contact button the chief's line may be reduced from its listening condition to that of a regular subscriber. It is a considerable disadvantage that no tell-tale device is provided to show the chief the exact position of the selector switch at any instant, for with the proposed present arrangement he must depend upon recognizing the voices of the operators in order to determining which one he is supervising. It is quite possible that the operators may notice the presence of the chief upon their circuits, as the closing of the secondary of the auxiliary induction coil will undoubtedly cause some change in the side tone of the operator's set, which may in time be recognized as a "danger signal."

COMMON BATTERY CENTRAL OFFICE SYSTEM.

Mr. Charles E. Scribner, of Chicago, has obtained a patent for a common battery switchboard circuit and system wherein, although only the usual number of signal lamps is required, each of these has but one significance., Thus, there are provided the usual line lamp as a calling signal, and the usual two connecting cord lamps. Of



SCRIBNER SWITCHBOARD.

these latter one signifies that the called party has not yet answered, while the second signifies that the conversation is completed and disconnection is desired.

A connection between two subscribers is shown in the accompanying diagram. Herein *g g* are the line lamps, *s* is the answering signal controlled by relay, *t*, connected in the called subscriber's battery supply lead, and *r* is the disconnection signal controlled by the repeating coil relay—a distinctive feature of this system. The extinguishment of the line signal is caused by the plug shunt, *l*, in combination with the common resistance, *f*. The action of the cord signals is in direct response to the relay contacts, as is easily traceable. The presence of the plug socket switch controlling the cord lamp battery

supply is a very objectionable feature, as all who have had experience with such devices can undoubtedly testify.

SHORT TRANSMITTER ARM.

An adjustable transmitter arm especially designed to bring the transmitter close to the back board has been patented by Mr. William Kaisling, of Chicago, the patent having been assigned to the Stromberg-Carlson Company. The base plate of the arm forms a socket let into the back board, in which the arm proper is pivoted. The pivot pin turns with the transmitter, and the stiffness of the joint may be regulated. The arm is finished with a spherical end in a manner such that the base socket is sealed in all possible positions of the transmitter.

CURRENT NEWS AND NOTES.

ENGLISH ELECTROCHEMICAL JOURNAL.—The *Electrochemist and Metallurgist*, an English electrochemical journal, which ceased publication several months ago, has been revived and will hereafter be published as the organ of the Faraday Society. It will contain all the papers and discussions before that society, in addition to other matter relating to electrochemistry.

A WIRELESS TELEGRAPH BLOCKADE.—A cable dispatch from Berlin of July 29 says: The combination of German wireless telegraph systems professes its ability to frustrate every attempt of Marconi agents to receive transatlantic messages in England by erecting a strong station on the German coast and propelling electric waves in the direction of the Marconi current.

DESTRUCTION OF LIGHTING PLANT.—How far strikers will go sometimes is evidenced by the following dispatch from Denver, Col., of July 29: The large electric plant of the Sun and Moon Company, near Idaho Springs, was destroyed with dynamite late last night. The watchman saw sparks of fire on the hill above the building, heard men running, challenged them and receiving no reply fired several shots. A moment later kegs of dynamite, which had been ignited and rolled down the hill, exploded, wrecking the big electric building and throwing the watchman fifty feet. The explosion shut off most of the lights in Idaho Springs, shook the city as well as mine buildings for miles around. Twenty-one leaders and officers of the local union were at once captured, and put in jail by the sheriff and indignant citizens.

ELECTRICITY AT DALNY.—The new Russian city at the Pacific terminus of the Chinese Eastern Railway Company is better equipped electrically than many an old or new world town. It has been created in the last three years. The electric light and power station, which is considered the finest electric plant east of Singapore, was finished over a year ago. This plant, which is a model in every detail, is fitted with three Ganz generators, with a total of 1,000 horse-power, and has a reserve space for additional machines to double its present capacity when required. There is a dry dock 380 ft. long, 50 wide and 18 deep, which is emptied by electric pumps in less than two hours. The harbor repair shops, etc., are all lighted and driven by electricity. The city is all lighted electrically, and there are telegraph and telephone offices.

TRAINING MOTORMEN.—In an open letter sent to Governor Bates, of Massachusetts, by Mr. W. H. Wheeler, of Worcester, it is suggested that the Legislature to see to it, first of all, that no motorman shall be employed on a country trolley line until he has had two years' experience, and has, besides, proved to a State licensing board that he is able to do the right thing in an emergency as well as to manage his car when no dangers are in sight. In the next place, Mr. Wheeler would have the State pass a law forbidding one rapid transit car to follow another at a less distance than 100 yards, and ordering the equipment of all such cars with a double set of air brakes, so that one could be used in case the other failed. Lastly, he would have it declared a criminal offense, even when no accident results, to "steal a switch," that is, for one car to pass the place appointed for meeting another. This act, he says, is often committed, sometimes with the approval of the passengers, who would rather take large chances than to endure prolonged delays, and therefore he would have rewards offered to those who betray the offenders.

ELECTRICAL ENGINEERING STANDARDIZATION.—The British Engineering Standards Committee has taken up the matter of electrical engineering standardization, four sub-committees having cognizance of this department. One—on generators, motors and transformers—is collecting evidence as to how far standardization can be introduced in the construction of these apparatus and their component materials. Another—on temperatures—is conducting experiments to determine the ability of different insulating materials to withstand heat, and also the deteriorating effects produced by their exposure to heat over long periods. A third is considering the standardization of cables and of underground conduits other than railway conduits, and is engaged in drawing up standard tables to cheapen the manufacture of cables. The fourth is occupied in the preparation of standard tables and specifications for wires and with other matters directly affecting the construction of telegraphs and telephones. The British Standards Committee has already established standards for structural steel sections, and has organized subcommittees for all the more important departments of engineering. The various government departments have representatives on the committee, which has just received a grant of $14,598 from the state.

BUCKET SHOP WAR.—There has been a sharp renewal down South of the bucket shop war, and a special dispatch from New Orleans of July 31 says: "A. S. Baxter & Co., incorporated in New York, and having offices here, have served out an injunction against the Western Union Telegraph Company and Gold and Stock Telegraph Company to prevent the telegraph companies from removing instruments from the firm's offices and requiring the companies to continue to furnish the plaintiffs with the quotations of the New York Exchange. Judge King signed a temporary order. At a meeting of the New Orleans Cotton Exchange resolutions were adopted in which the Exchange refused to sign the agreement for New York quotations. The New York Exchange, as stated in the resolution, required the New Orleans Exchange to sign an agreement against bucket shops and refused to treat with the New Orleans Exchange regarding New York quotations, except through negotiations with telegraph companies. The telegraph companies have said that unless the agreement is signed service from New York will be discontinued. Resolutions adopted declare that the New Orleans Exchange will refuse to negotiate other than with the New York Exchange direct." This situation affects a large volume of telegraph business.

LETTER TO THE EDITORS.

Increase of Traction Magnetically.

To the Editors of Electrical World and Engineer:

SIRS:—In your issue of June 27 I read with much interest the article entitled, "Magnetic Increase of Traction," in which was described an invention of Mr. A. A. Honey, of Chicago, recently patented for magnetically augmenting the weight of a car or locomotive so as to produce a greater tractive effort. The device consisted of a pivoted arm upon which was wound a coil of wire, while the outer free end carried an idler wheel to run on the rail when the coil was energized, and afforded a closed magnetic circuit from the arm to the car journal, the car wheel, the rail, the idler wheel and back to the arm. The whole scheme is ideal, if practicable, and ought very shortly to place the sand box in exile. However, upon investigation, I am forced to doubt its practicability, for among the experiments conducted was one, the results of which I cannot credit upon the basis of the data there presented.

The test was made, Mr. Honey tells us, at Seattle, Wash., on a double-truck car, which was equipped with two 50-hp motors. Not being familiar with Pacific coast practice, I assumed the total weight of the car to be that of the Brill Company's standard type, using two 50-hp motors, i. e., 30,000 pounds. To be brief, it was stated that the tractive effort without the use of the device was 1,500 pounds, and with it 5,250 pounds. Since the tractive effort varies as the downward pressure upon the rails, this implies that the equivalent weight of the car was increased to 105,000 pounds, from which, subtracting the weight of the car, 30,000 pounds, there remains 75,000 pounds as the amount added by the four magnetic devices, or 18,750 pounds by each one. Now, allowing a flux density in the magnetic path of say, 100,000 lines per square inch (a very high degree of

saturation for that grade of iron) an attraction of about 130 pounds per square inch will result. This requires an area of 144 square inches in the smallest cross-section of the magnetic link, which cannot be greater than the cross-sectional area of the rail. To the best of my knowledge there is no car rail made, standard or special, with a cross-sectional area equivalent to 1 square foot.

In conclusion, I would say that this letter is intended, not as a criticism, but rather as a plea for enlightenment, and if these assumptions are incorrect, I shall be grateful to Mr. Honey or anyone else, who will point out the error, or show any other way in which such a great attraction could be made possible.

EAST ORANGE, N. J. H. R. C. LEIGH.

DIGEST OF CURRENT ELECTRICAL LITERATURE.

DYNAMOS, MOTORS AND TRANSFORMERS.

New Single-Phase Motor.—SCHUELER.—An illustrated article, in the first part of which the author discusses the principles underlying the construction of the repulsion motor. He then describes his improvement in its construction, which consists therein, that the transition of the motor from repulsion to rotating field, i. e., the direct short-circuiting of the armature, does not take place all at once, but that certain points in the armature winding are first connected through resistances, which are then gradually short-circuited. After short-circuiting has taken place, the commutator loses its current automatically, as a much easier way is furnished for the current through the short-circuited windings than through commutator and carbon brushes. The author states that the advantage thus gained is two-fold. First a rotating field motor has a considerable torque even at a lesser number of revolutions and with less consumption of current, if its rotor is short-circuited by suitable resistances. Secondly, the repulsion torque is utilized, till the resistances are completely short-circuited. The motor, therefore, works during a time as repulsion and rotating field motor. Tests were made by the author with a 5-hp motor, which had three slip rings and a commutator; the slip rings were connected with three places in the armature winding, which were 120° apart. The slipping brushes were connected with a three-phase controller, and the torque and the current strength dependent on the number of revolutions, were noted, and such a position of the controller as was most favorable for each number of revolutions was sought for. It was found that the motor has double the normal torque at the moment of starting, and can exert at the minimum 1.4 times the normal torque during the whole starting period. The starting current amounts at the moment of starting to not quite twice the normal value, and decreases gradually with increasing number of revolutions, until it reaches the normal current. The disagreeable kick of the older forms of repulsion motors is entirely avoided in this construction. As the motor exerts a considerable torque at all speeds, its speeds can be regulated by the insertion of resistances into the slip ring circuit over wide limits, exactly as with rotating field motors. When resistance is inserted into the slip ring circuit, part of the current takes its way automatically through the commutator; the motor works then at the same time as repulsion and as rotating field motor. In its practical form the motor becomes simple; the armature winding is an ordinary direct-current winding, which is connected in the way usually adopted in converters, with commutator and three slip rings. The commutator can be kept very small, because it is only traversed by current in the starting period. The motor can be reversed by arranging two sets of brushes. This is stated to be of great advantage in railroad work with high pressures, as the high potential with this construction does not need to be taken into the controller at all. It is stated that there are no difficulties in building a 50-hp traction motor for 10,000 volts. The exciting winding has no crossed coils, and therefore can be easily and safely insulated; one end of the winding is earthed, therefore only one high-potential wire has to be taken through a unipolar main switch and permanently connected directly to the collector, which is of course like the line wire, only unipolar. The controller and starting rheostat work only with low pressure. As far as safety of running at high pressure is concerned, the single-phase repulsion motor should be not inconsiderably superior to the polyphase motor.—*Elek. Zeit.*, July 16.

Induction Machines and a New Type of Polyphase Generator.—EBORALL.—A paper illustrated by diagrams and cuts, in which the author gives an account of a new type of polyphase generator designed by Heyland. The generator is stated to be new; first, because, although synchronous and of nearly standard construction, the operation of the field system is of the nature of that of asynchronous machines, the principle involved being applied, however, in a new manner. In the second place, the machine is self-exciting and properly compounded or overcompounded, not only with regard to the magnitude of the current, but with regard to its phase difference. The principles of Heyland's method of compensating induction motors with regard to their wattless magnetizing currents, are first described. The complete diagram of connections and circuits of a new type of 20-kw self-exciting and compounded three-phase generators are shown in the adjoining figure. Here *A* is the main wind-

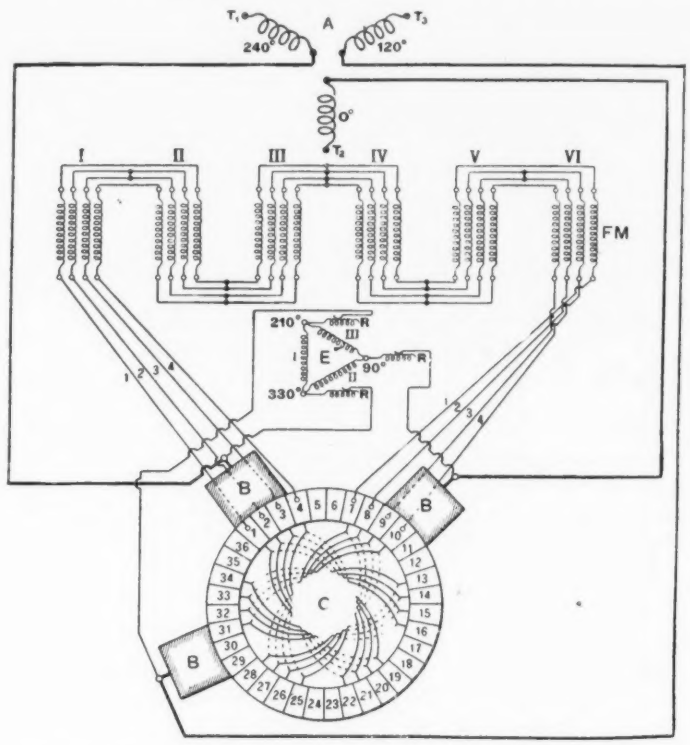


DIAGRAM OF POLYPHASE GENERATOR CONNECTIONS AND CIRCUITS.

ing of the stationary armature, having main terminals, T_1, T_2 and T_3. *E* is the exciting winding on the armature, provided with the three-legged regulating resistance, *R R R*. *F M* is the four-circuit winding of the rotating six-pole field system. *C* is a 36-part cross-connected commutator with brushes, *B B B*, for the commutation of the exciting and compounding currents. The field winding of the new type of polyphase generator, consists of a number of parallel circuits (usually four are amply sufficient), connected together and to the commutator, as shown in the figure, where the field poles are numbered I to VI, inclusive. The rest of the connections and arrangements are exactly similar to those of the compounded asynchronous generators. Instead of the special star-connected winding, there is a revolving magnet wheel wound and connected up in an entirely analogous manner. The machine described, being wound for a low pressure, is not provided with transformers for furnishing the compounding and exciting currents. The former are provided by the armature winding itself, the common function of the three

phases being made at the commutator, while the latter is provided by a small auxiliary mesh-connected winding on the armature. Exactly similar means would be provided for furnishing the compounding and compensating currents for a low-pressure non-synchronous generator. The regulating resistances in the exciting current circuit and the commutator cross-sections are shown in the above figure. The current in the field windings is always a direct current, and the increase of excitation required for the load is provided by the compounding current led into the commutator from the armature. The commutator is stated to work as smoothly and sparklessly as an ordinary ship ring. The interconnections between the parallel field windings (which windings, together with their interconnections, constitute in reality a class of three-phase winding) perform two important functions. They prevent an interruption of the circuit when the commutator segments that are not connected at all, pass under the brush, and, on the other hand, when the brush short-circuits the two sections, the effects of the short-circuit are damped out. During the period in which one circuit of the winding is withdrawn from the circuit, owing to one of the segments to which it is connected leaving the brush, the current takes the alternative path through the circuit in parallel with it, and the self-induction of the winding thus withdrawn is cancelled by the mutual induction of the circuit-carrying current, and hence sparking is entirely prevented. The action in this respect of the multiple circuit winding is entirely analogous to that of the six-branches star winding referred to above, the commutator to which the former is connected being, however, virtually a two-part commutator, with each part subdivided into a number of segments of the same polarity, corresponding to the number of parallel circuits of the field winding. The actual pulsations in the field strength are, on account of the nature of the field winding, quite insignificant, the pulsations being nearly completely damped out by reason of the induced currents produced by them in the closed circuits of the field coil. A table of compounding tests given in the article shows that such machines can be made self-regulating for constant terminal pressure, or can be overcompounded, without any difficulty whatever. Thus a series of tests showed that the terminal pressure at no load was 247 volts, at 39 amp. ($cos\ \phi = 0.11$), 270 volts, and at 30 amp. ($cos\ \phi = 1.0$), 255 volts, the speed being constant. Thus, under these circumstances, the machine overcompounds to the extent of about 10 per cent. on a load of a power factor of 11 per cent., and about 4 per cent. on the non-inductive load, with a fixed adjustment of the field-regulating resistance. Between these two power factors the amount of overcompounding is simply dependent on the actual power factor of the load for the same currents. The author states that it should be specially noted that this variation in the amount of overcompounding for a given current is just what is wanted in practice, for the drop in the feeders, transformers, etc., is dependent upon the power factor of the load, being a minimum, when the load is non-inductive. A power station laid out with such machines could consequently be made to be nearly self-regulating for constant pressure at the receiving end of the transmission line, no matter what the magnitude of the load or the nature of its power factor happens to be. Apart from the great advantages which the above method of exciting and compouding polyphase generators possesses from the point of view of adaptation to the standard armatures and field carcases of ordinary synchronous alternators, the author states the following additional ones: The otherwise necessary exciter disappears and a very simple arrangement takes its place. The design of the generator becomes electrically better, for the air-gap length is fixed solely by mechanical considerations, and hence a large saving in field copper results (25 to 30 per cent.) compared with the ordinary alternator.—Lond. *Elec.*, July 10.

POWER.

Electricity in Factories.—An editorial giving an abstract of the annual report of the British Electrical Inspector of Factories, issued by the Factory Department of the home office. The inspector states that the general tendency is toward greater safety to the workman, as turbines and engines, of which all the moving parts are entirely closed, are very generally increasing in favor. Developments in steam practice point to the probable increasing use of steam superheated to a very high degree, up to as high as 800° F., tests of engines showing a marked economy in steam consumption under such conditions. The last division of the report details the precautions to be taken against accident, and the inspector supplements his remarks by a summary of some of the conditions, often met with, which have been the cause of accident, or offer unnecessary risk in electrical stations. This, in the opinion of the editors, is perhaps the most valuable part of the whole report, and is deserving, they say, of the closest study by central station and other engineers, who have charge of electrical generating stations or electrical distributing systems.—Lond. *Elec. Eng.*, June 26.

Electric Coke Measuring Machine.—An article on the coke-handling in French gas works, containing among other matters a description and illustration of a new electrically-operated machine, which is used for taking the coke from the heap, measuring it and putting it into racks. It consists of a bucket elevator mounted at one end of a platform, the machine being made easily transportable over the yard. The elevator is worked by an electric motor, supplied with current through overhead wires, the motor of 3½ kw and the transmission shaft being suspended on the frame plates, near the rear axle. The coke is delivered from the buckets into a hopper, which acts also as a screen. Three chutes communicate with the hopper and take the coke to three skips for measuring and filling the sacks. The motor being placed in the rear of the machine, increases the stability. Feeding centers for the current supply are put down at various points in the yards, in order to reduce the length of overload wires to a minimum. The machines are very rapidly started and their output varies from 825 to 1,240 bushels (whether per hour or per day is not stated), according to size of coke. A continuous platform, 216 ft. long, for the purpose of drying the coke after quenching, is also operated by an electric motor of 11 kw.—Lond. *Eng'ing*, July 17.

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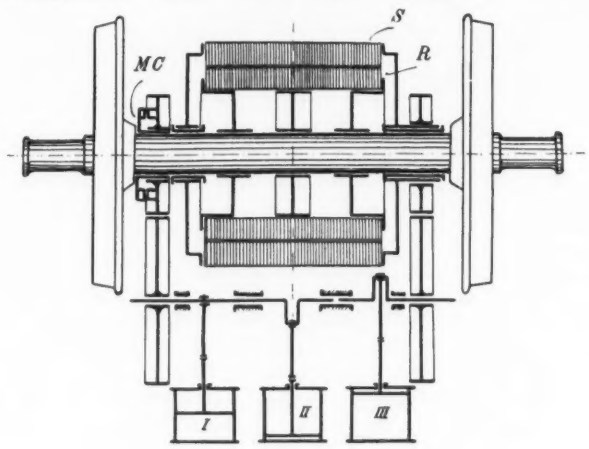
Electric Crane Experiences.—Williams.—An article giving the writer's experiences with electric cranes in actual operation, from a mechanical standpoint. He gives a number of instances where mechanical troubles occurred and describes how they were remedied.—*Am. Mach.*, July 23.

Electric Hammer.—An illustrated description of a hammer driven by a flexible shaft from a small portable electric motor placed in any convenient position.—*Scien. Am. Suppl.*, July 18.

Electricity in the Service of Agriculture.—Buderus.—An article, enumerating in a popular way the various existing and possible applications of electricity on farms and the advantages accruing therefrom. It is stated that it has been proved experimentally that the efficiency of the threshing machines under similar conditions is about 10 to 15 per cent. greater with electric drive than if driven by a locomobile. He gives examples of a number of installations put up in Germany, where various operations are performed by electric motive power.—*Elek. Rundschau*, July 1, 15.

TRACTION.

Single-Phase Road with Pneumatic Acceleration.—Blank.—An illustrated description of the Arnold system for utilizing single-phase current for traction purposes. The principle consists in the suitable combination of a single-phase induction motor with a mechanical accumulator, consisting of air receivers and compressor cylinders. The arrangement is shown in the adjoining figure. The rotor, *R*,



PNEUMATIC ACCELERATION.

of a single-phase induction motor is in fixed connection with the driving axle of the car, while the stator, *S*, can rotate freely around the axle and moves the compressor piston, *III*, by means of suitable

gearing. Cylinder *III* is connected by piping to a compressed air cylinder located under the car. In the same manner a compound compressed air engine, *I* and *II*, with cranks 90° apart, is in connection with the compressed air receptacle. The engine can drive the motor axle by means of cogs during the period of acceleration, but is cut out after the car reaches its normal speed, by means of the magnetic clutch, *M C*. All three cylinders have valves actuated by electricity, which make it possible in the same cylinder either to produce compressed air through the mechanical motion of the piston or to do work by introducing compressed air into the cylinder. If the cylinder furnishes compressed air, the suction and pressure valves act like normal pump valves; that is, they are worked automatically at one side by the pressure acting there. But if the cylinders are to furnish work by the introduction into them of compressed air, these valves are actuated by a solenoid the core of which is in connection with the valve seat. This takes place by means of a commutator on the crank shaft, which commutator allows of regulation for different degrees of admission of air with the help of a suitable controller. The running of the car takes place in the following phases: 1. Standing still in the station. Rotor as well as piston *I* and *II* stand still, while the stator possesses the full speed opposite to the direction of motion of the car, and transfers its work to piston *III*, thereby furnishing compressed air up to 10 atmospheres in the cylinder. 2. Starting. The compressed air thus obtained is introduced into the cylinders *I* and *II* with 90° admission, which allows a start in every position of the car. Thereby the rotor velocity decreases, while that of the stator decreases by the same amount. As the speed of the car increases, the controller is gradually regulated to lesser amounts of admission, until the speed of the rotor has increased to 100 per cent., when the stator stands still. When the rotor or the car axle has reached full speed, compressed air is introduced into cylinder *III*, to furnish a cushion for the reaction pressure of the stator. At the same time the admission of air to cylinders *I* and *II* is cut off, and the magnetic clutch, *M C*, is released, thus cutting out the compound engine *I* and *II*. The motor now furnishes all the power. If the speed of the car is to be increased above the synchronous speed of the motor, compressed air with a certain degree of admission is introduced into cylinder *III*. The direction of rotation of the stator is the same as that of the rotor, thus producing an increase of speed of the rotor. A lesser speed than the synchronous can be produced by rotating the stator in the opposite direction.—*Elek. Zeit.*, July 16.

Surveys for Electrolysis; their Results.—MAURY.—A paper read before the recent meeting of the American Water Works Association dealing with the subject from the standpoint of the water works manager. After remarking that at least five important electrolysis suits are now before the courts and that many people are awaiting the decision in order to start similar ones, the author proceeds to give suggestions as to how the flow of current from rails to the pipes, along the pipes and from the pipes back to the rail, may be traced, in order to prove its origin and fix the responsibility. The first step is the reading of the difference of potential between hydrants and rails at various parts of the system with a doube-scale voltmeter, having the zero in the middle of the scale. This is for the purpose of getting a general idea of the normally positive and negative areas, so as to locate the best places for afterwards exposing the mains for inspection. The author states that pitting is not found only in the territory in the neighborhood of the power station, where current leaves the pipes to return to the rails, but that it will usually be found that at the extreme dead ends of the car tracks the mains will be strongly negative to the car rails when cars are using current near by, and slightly positive to the rails at all other times. He says that unless supported by the actual measurement of current flow and inspection of the pipes themselves, the voltmeter readings show insufficient evidence on which to base a suit, and their importance has been too often exaggerated. After these voltmeter readings the next step is to expose the mains at a number of places, where they are normally positive or negative, or where they are alternately positive and negative. The current is measured by the author by the drop of potential method, by filing bright spots a certain distance apart and measuring the drop of potential with a millivoltmeter. The author gives a couple of tables for wrought-iron and cast-iron pipes of different diameter, in which he has calculated the current for 1 millivolt drop for various distances between measuring points. The author then discusses the injuries caused to the mains and service pipes by currents which leave their outer surface wherever they are positive to the adjacent earth. He states that the last two piping systems examined by him showed an average depreciation all over the entire system of mains and due only to outside pitting on the mains of between 21 and 23 per cent. The other class of injury, namely that caused by pitting inside the mains near the joints or on the outside of spigot ends under the lead at the joints or inside the sockets of bells over the lead or on the lead itself, is considered by the author as the most serious. The injury goes on most rapidly where the mains are carrying most current, and the territory in which worst joint pitting is found is a zone surrounding the location of the power station and the return feeders, but at a considerable distance from them. This is explained by the fact that the water mains gather current at their outer ends up to the point where at the instant there is no difference in potential between mains and rails, and lose it from this point in towards the power station, thus carrying the greatest current at about this temporary neutral point. The author then goes on discussing the various remedies which have been proposed and comes to the conclusion that there is but one real remedy, and that is the complete removal of the current from the ground. He believes that a conviction that this would be the best policy is shared by not a few of the fair-minded and far-sighted railway men. But, he says, if the street car companies do not voluntarily make the change, then they should certainly be compelled to do so.—*Eng'ing News*, July 23.

New System of Automatic Car Control.—A description illustrated by diagrams, of an interesting demonstration of a new system of car control. The car on which the new apparatus was installed was a four-wheel double-decker, weighing about 9 tons and equipped with two Brush motors. The alterations in the electrical equipment are as follows: *a*. The field windings have been changed from series to shunt with the addition of an auxiliary series winding; *b*. The motion of the power handle has been limited to the series notches; *c* a speed control lever has been added, interlocked with the power lever; *d* an automatic switch has been introduced into the emergency circuit to cut out resistances when the line current fails. No change has been made in the armatures or their connections. It is stated that the net saving in energy obtained over a large number of trial runs appears to be about 30 per cent., as measured on the car. Instead of 140 amp. the maximum demand on the line is reduced to 80 amp. per car. Regeneration takes place automatically on a descending grade, or by pulling back the speed lever quickly. In descending hills the regenerative effect is usually 40 amp., sometimes rising to 50 amp. There are two handles on the controller, one for the field winding and the other for the armature. The latter cannot be moved until the former is at the notch for maximum excitation of the field, but it can then be advanced to any position. Resistance is gradually inserted into the field circuit to increase the speed by advancing the lever controlling the field resistances. Should it be desired to decrease the speed or to cause the motors to generate and return current to the line, it is only necessary to move this lever backward, thus cutting resistance out and providing an exceedingly strong field. When this lever reaches the position in which all resistance has been cut out, the armature lever flies back and breaks the circuit unless it is purposely held forward. Owing to shunt motors being employed, current is returned to the line automatically when the car descends a gradient. If the trolley comes off the line, the motorman has merely to press a small handle attached to the field resistance lever, which switches in a series winding, consisting of many turns of fine wire, and short-circuits the motor. It is perfectly immaterial as to what position each lever is in when this operation is performed. The effect is exactly the same whether the car goes forward or commences to run backward; immediately after the auxiliary series winding is connected, the car is pulled up almost to a standstill and may be brought to a dead stop by means of hand brakes.—Lond. *Elec.*, July 17.

Des Moines City Railway.—A description of the road with plans of the new power station and car house. A novel method of laying a return feeder on the bed of the river is described. When the river was frozen a rail, with cast-welded joints, was laid on the ice, and when the ice melted the rail sank and the company had a permanent feeder from one side to the other.—*St. R'y Jour.*, July 11.

REFERENCES.

Traction Company in Texas.—An article describing the system of the Northern Texas Traction Company. The system is 37 miles

long and includes the city system in Fort Worth. The track construction and power station are thoroughly described. Originally oil was used as fuel in the station, but a test was made showing that 1 pound of coal equaled 0.66 pound of oil, and coal is therefore far more economical. Tests were also made to determine the efficiency of the generators, rotaries and transmission line; full particulars are given.—*St. R'y Jour.*, July 18.

Recent Improvements in Canal Engineering.—Fitz-Gibbon.—A paper read before the Engineering Conference in London. The author discussed several systems of electric traction.—Lond. *Elec.*, July 3.

Electric Railroad Statistics for Germany.—A table covering 18 large pages, giving the following data of all the electric railroads in operation and in course of construction in Germany, viz.: location and name of company, date of opening, system of current distribution, length of track and road, gauge of track, highest grade, number of motor cars, number of trailers, number and normal capacity of car motors per car, current, whether obtained from own power station or from another central station; total power in kilowatts of electric machines used for traction, including reserve; capacity of the storage batteries used in the power houses for traction purposes in kilowatts, and other remarks.—*Elek. Zeit.*, July 9.

Railway Power Station in London.—An article describing the power station of the underground electric railways of London. The station is being erected to operate the Yerkes system of underground railways, and will have a capacity of 57,000 kw. The power equipment will consist of ten 5,500-kw steam turbines, each directly connected to a three-phase generator wound for 11,000 volts and 33⅓ cycles per second. Plans and sections of the station are given. —*St. R'y Jour.*, July 18.

Installations, Systems and Appliances.

New Electricity Works at Manchester.—The conclusion of the well-illustrated serial previously noted in the Digest. The present installment describes the generating station at Bloom Street, mainly supplying power to tramways. The boiler house contains 11 tubular boilers, each of a total heating surface of 5,140 sq. ft., working at 160 pounds per sq. in. The customary equipment of economizers, feed water heaters, etc., is provided. The generating plant consists of four steam dynamos, each giving normally 1,800 kw at 75 r.p.m. The engines are of the vertical compound type, with the dynamos between the cranks. Each engine has a fly-wheel of 125 tons weight, and teeth are provided in the wheel's periphery for the electric barring gear. Each generator has a capacity for 25 per cent. overload continuously or 50 per cent. for short periods. The commutator and armature diameters are 10 ft. and 12 ft. respectively. The commutator is constructed of 900 segments, carbon brushes are used and each holder is bolted to a central ring, connected through suitable gearing, to hand wheels at each end of the machine. The field frame contains 20 poles. The machines are designed for 75 r.p.m. and supply current either at 410 to 440 volts for lighting or 500 to 550 volts for traction. For the former they are connected as shunt-wound generators, for the latter as compound-wound, the change being effected by a switch pillar at the side of each machine, with interlocking gear to prevent the possibility of an error made in changing over. The switchboard arrangements are also described.—Lond. *Elec. Rev.*, July 17.

Rand Central Electric Works.—A well-illustrated article, describing the largest central power station in British South Africa. The generating plant consists of four 1,000-hp triple-expansion condensing engines, directly coupled to four 800-kw, three-phase alternators, generating electricity at 800 volts with 50 cycles per second. The engines are frequently called upon to furnish 1,200 hp. The steam pressure is 175 pounds per sq. in. Regulation is performed by means of a special motor-driven regulator. The generators are of the Siemens-Halske stationary armature type, wound on the star system; the rotating fields are excited from dynamos carried on the ends of the main shafts. The exciters are of the internal field type with external commutator, and supply current at a pressure of 120 volts. Regulation is effected by means of field and main current rheostats, which are also operated by a small motor controlled from the switchboard, the electrician in charge thus having complete and instant control over both the excitation and the governing of the generators. The boiler house contains eight multitubular boilers, each of 500-hp capacity and a heating surface of 3,300 sq. ft., generating steam at 180 pounds per sq. in. There are sixteen 200-kw transformers, which raise the pressure from 800 to 12,000 volts. The line consists of 28 miles of conductors, running along the veldt to Johannesburg and supplying power to the various mines on the way. The cables are three double bare wires of 140 sq. mm. cross-sectional area for double wire, supported by steel poles 28 ft. high, the distance between poles being 90 ft. To overcome self-induction and atmospheric effects, the insulators are so arranged as to give a continuous helical twist to the line, the original position of the insulators recurring at every sixth pole. A high line efficiency is obtained; the loss by leakage, in resistance and in transformers, has been found to be only 7 per cent. during the time of maximum load. Each mine is supplied with a separate transformer station, where the pressure is reduced to 120 volts for lighting and 250 or 500 for power purposes. The station furnishes 800 kw at a pressure of 2,000 volts, which must be kept within 2½ per cent. The current is furnished to a sub-station, one compartment of which contains the company's transformers, etc., which step the pressure down to 2,000 volts and deliver the current to the 2,000-volt bus-bars in the municipality compartment. The transformer chamber contains eight 100-kw, three-phase transformers, five of them air-cooled and the rest of a new oil-insulated type. Two regulators are provided, one of a transformer type, arranged to add or deduct from the bus-bar pressure to the extent of 250 volts. The other type, recently installed, is in the shape of a small induction motor, the small motor being placed on top. This, through worm gearing, operates a crank turning the rotor, which moves through two right angles. This alters the pressure of the circuit by raising or lowering the power factor of the transformers. The highest maximum load on the works is 2,200 kw, the average maximum load 1,600 kw.—Lond. *Elec. Rev.*, July 10.

Condensing Plant for Central Electric Stations.—Summerfield.—The first part of an illustrated article. The author thinks that in many cases in power stations the total quantity of fuel or water used is so small that the value of the amount saved by any extra appliance is not equal to the amount of the interest and depreciation on and cost of working that appliance. In the case of a condensing plant, for instance, before any real saving can be effected by it, the author comes to the conclusion that unless an average day and night load of about 150 hp is obtained, there will be no practical saving in condensing, while below that a direct loss is soon incurred. A condensing plant is usually installed on the separate or the central plan, in the former case each engine being provided with its own condenser and air and circulating pumps, so that each unit is complete by itself, while in the latter case a common air main is used, with a connection to each engine exhaust chamber. Unless ejector condensers or some other simple form of condensers are used, however, the first cost of a separate condensing plant is too great to allow of its adoption except for large engines, say of 1,000 hp and over, in which cases it is no more expensive than a central plant and has greater advantages. Several types of surface and jet condensers are illustrated.—Lond. *Eng'ing*, July 17.

Wires, Wiring and Conduits.

The Arrangement and Control of Long-Distance Transmission Lines.—Cowan and Andrews.—The first part of a paper read before the Manchester section of the Institution of Electrical Engineers. After a brief review of the different current distribution systems, the authors say that the maximum pressure for three-phase alternating-current distribution actually in practical operation is 80,000 volts. There is, they say, no reason why this should be the limit, as transformers have been worked well above 100,000 volts, and with liberal spacing of the overhead wires the electrostatic leakage can be sufficiently reduced. After touching on the line capacity current, the loss in conductors, poles, etc., the authors describe the winding and arrangement of an improved variable induction transformer, which is also illustrated in the article. Instead of the secondary winding being wound entirely upon the ring, it is wound half on the movable core and half on the ring; the primary winding is wound on the movable core. The result of this arrangement is that in a certain relative position the magnetic lines induced by the primary winding cut the half of the secondary wound upon the movable core in a positive sense, and the half of the secondary on the ring in a negative sense; the resultant e.m.f. in the secondary, is therefore, *nil*.

When, however, the movable core has been rotated through an angle of 180°, and the magnetic lines cut both the secondary windings in a positive sense, the resultant e.m.f. is the sum of the two, and, therefore, a maximum. In intermediate positions intermediate secondary pressures are obtained. There is practically no magnetic leakage between the primary winding and the half of the secondary winding on the movable core, and the number of secondary turns on the iron ring being half of the total, the tendency for magnetic leakage to occur at the air-gap is proportionately reduced. The result is that there is a total drop of only 6 to 7 per cent. on the secondary between no load and full load. A further improvement consists in fixing shading coils on the moving core at certain positions, which neutralize the inductance of the secondary circuit when the movable core is in intermediate positions. The slots in the ring which contain the secondary coils are so placed that the area of gap between the movable core and the ring is as large and as equal as possible in all positions, thereby keeping the magnetizing current as low and as constant as possible.—Lond. *Elec.*, July 10.

Moisture in Conduits.—MURDOCH.—An article in which the author comes to the following conclusions: *a.* Seamed conduit or socket-jointed conduit, should never be buried in plaster, at least never in walls, which are subject to the action of the weather, especially if these are of solid brick or stone. *b.* Water tightness should be aimed at, at any rate, when the conduit is laid on sweaty walls, under plaster or stone floors, and in draughty situations. *c.* Conduits, with insulating lining will probably be slightly less subject to rapid variations of temperature, and consequently condense less. For extremely damp situations and high voltages, the conduit does not appear to the author to be particularly applicable. It is also doubtful if the metallic continuity could be relied on in an emergency. The lead-covered, water-tight systems appear here to have a great advantage over the conduit, although even lead is subject to corrosion by water. The author thinks that wiring in damp places has hardly yet received the attention its importance warrants, and it ought to interest fire insurance people especially in view of the higher voltages now becoming common. He cites a case where water dripped upon a wire, which became gradually corroded and finally heated up and caused a fire.—Lond. *Elec.*, July 10.

ELECTRO-PHYSICS AND MAGNETISM.

Radioactive Gas from Metallic Mercury.—STRUTT.—An article giving the results of a series of experiments by the author, from which he draws the following conclusions: 1. A radioactive gas or emanation can be obtained by drawing air over hot copper or by bubbling it through hot or cold mercury. 2. By repeated circulation through mercury very considerable activity can be obtained, activity of quite a different order from that of metals as ordinarily observed. 3. The mercury emanation deposits radioactive matter on the walls of the vessel containing it. This deposit remains after blowing out the gas, and possesses at first perhaps ⅙ of the activity of the latter. This induced activity falls to half its value in 20 minutes. 4. The emanation itself decays in activity according to an exponential law, falling to half value in 3.18 days of 24 hours each.—*Phil. Mag.*, July.

Rotation of Liquids Under the Action of a Magnetic Field.—URBASCH.—A contribution of Prof. Nernst to the discussion repeatedly mentioned in the Digest, between the author and Prof. Drude, as to whether a magnetic field could produce rotation in an electrolyte. The author referred the question to Nernst, and the latter now finds that the rotation actually takes place under the right condition of experiment. The sense of rotation of the liquid is reversed, when the magnetic field is commuted.—*Zeitsch. f. Electrochem.*, June 25.

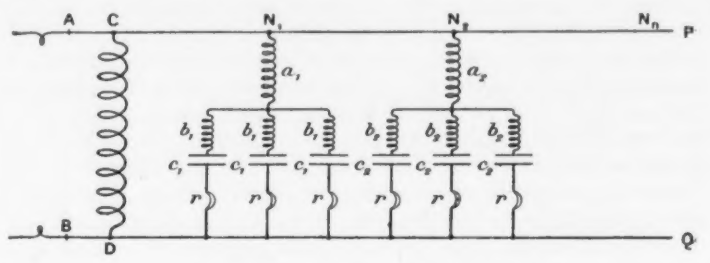
REFERENCES.

Recent Developments in the Study of Radioactive Substances.—MERRITT.—A paper read before the Cornell Section of the American Chemical Society, containing a clear and comprehensive review of the present state of our knowledge on the subject of radioactivity.—*Science*, July 10.

Cathode and Röntgen Rays.—DASTRE.—A long historical article, describing the properties of these rays. Translated from the *Revue des Deux Mondes* for the Smithsonian Report and reprinted in *Scien. Am. Supp.*, July 4.

ELECTRO-CHEMISTRY AND BATTERIES.

Production of Nitric Acid by Electric Discharges.—KOWALSKI.—In a paper read before the Soc. Intern. des Elec., Paris, the author describes his method for the production of nitric acid from the nitrogen of atmospheric air. He claims that for a maximum yield there must exist a certain relation between the intensity of the current which produces the arc, the difference of potential at the electrodes, between which it is struck, and the frequency of the current. A maximum of nitrous vapors has been obtained by the author with a current of about 0.5 amp., a difference of potential of 50,000 volts and a frequency between 6,000 and 10,000 periods per second. With ordinary air 52 to 55 grams of nitric acid have been obtained per kw-hour. If about 50 per cent. of oxygen is added, this yield can be nearly doubled. The apparatus is shown in diagrammatic sketch in the adjoining figures. *A* and *B* are the terminals of the secondary of a high-tension transformer. *A P* and *B A* are two parallel conductors. The conductors are connected by



PRODUCING NITRIC ACID BY ELECTRIC DISCHARGES.

groups N_1, N_2, each consisting of a self-induction coil, *a*, in series with three coils, *b*, connected in parallel, each of the latter being in series with a condenser, *c*, and arc, *r*. The coil, *a*, is for the purpose of preventing the oscillating discharges from reacting upon the transformer; it is calculated in such a way that its resistance is very great for the high-frequency currents which are produced by the charge and discharge of the condensers, and is relatively small for currents of ordinary frequency coming from the transformer. The whole system produces a phase lead, the compensation of which is effected by arranging a self-induction coil, *C. D*, between the terminals of the transformer. One of the most difficult parts of the apparatus was the condenser, for which, as dielectric, small glass tubes silvered on both sides, have been found to give the best results. The energy loss in these condensers is not more than one per cent.—*Bull. de la Soc. Intern. des Elec.*, June.

Chlorine Smelting, with Electrolysis.—SWINBURNE.—The first part of a paper read before the recently formed Faraday Society in England. The author gives an outline of a process in which he proposes to substitute a chloridizing process for the ordinary metallurgical roasting and subsequent reduction processes. The ores are thus converted into salts of the metals, which can be electrolyzed easily and cheaply. In the case of a sulphide ore, for instance, the ore is treated with chlorine so as to displace the sulphur and absorb all the chlorine. The chloride is then electrolyzed to get the metal and recover the chlorine. In the case of pure galena the material is treated with hot chlorine so as to form lead chloride and sulphur. The sulphur is condensed as brimstone, and the lead chloride is electrolyzed in the fused form, producing lead and chlorine. If silver and gold are present the fused chloride of lead is treated with metallic lead. This replaces any gold or silver there may be and the precious metals alloy with the remaining lead, so that ultimately a bullion is produced as rich as may be desired, the only limit being its melting point, which must not be too high. The cost of the desilvering by the ordinary process is thus stated to be saved. Mixed ores, such as Broken Hill slimes, which contain zinc, lead, iron, silver and gangue, are treated in the following manner: Hot treatment with chlorine converts the whole of the metals into chlorides, producing a broth of mixed, fused chlorides and gangue. The silver is extracted by substitution of lead, the lead is extracted by substitution of zinc and the iron is thrown out as ferric oxide, not as metal, zinc oxide being used as substitute. The gangue is gotten out by filtration. There is then nothing left but zinc chloride, and this is electrolyzed to yield zinc and chlorine. The author states that the process is cyclical with regard to chlorine; the formation of chloride of sulphur would be fatal to the process for the reason that both sulphur and chlorine would be lost. It has been discovered that sulphide ores can be treated on a large scale by chlorine and give off sulphur only. It is said also that the electrolysis of zinc chloride was supposed to be very difficult or impossible, but that

all difficulties have now been overcome. The electrolytic vats are internally heated as in the case of aluminum. The cathode is fused zinc and the anode is carbon. The vats are kept under light suction, so that if there are any leaks, air is drawn in instead of chlorine leaking out. The zinc chloride is made anhydrous in a series of preliminary vats, which are fitted out with inexpensive carbon anodes, which gradually are consumed. The anhydrous zinc chloride from these vats is then taken to the final electrolysis vats. The vats are stated to be very simple, merely iron cases filled with firebrick. With a vat on which a 3,000-amp. current was run, the voltage amounted to 4 volts. The current efficiency is practically unity. Lond. *Elec.*, July 10.

Electricity in Coal Mines.—A long editorial, dealing with the use of electricity in coal mines and discussing the best system to be adopted for distribution. The three-phase induction motor is considered the simplest solution of the problem, in view of its absolute safety, as it cannot spark. Though it was shown that continuous-current motors protected in a proper manner with gauze, etc., were practically harmless, when sparking in a highly explosive mixture, the three-phase is considered safer than such an elaborate system of protection, which though efficient at the beginning, may not remain so. After all, efficiency is not such an extremely important point, when human life depends upon safety and reliability, and moreover a saving of 5, 10 or even 20 per cent. is not of great moment to a mine owner who gets his fuel at the minimum figure. It is not so much in first cost and working costs that money is saved by the adoption of electricity in mines, as in time and convenience. There is room for considerable extension in the application of electricity in mines, and the subject is one to which coal owners and engineers should give their utmost attention.—Lond. *Elec.*, July 10.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Motormeters on the Ferrari Principle.—BUSCH.—A paper read before the recent annual meeting of the German Electrotechnical Society on some new constructions of instruments by the author. He lays down the principle governing the construction of meters in general and gives a detailed explanation of the action of the Ferrari meter. The meters are constructed for loads free of induction and for loads of any kind. The construction of a meter of the latter type is shown in the accompanying figure. The shunt stator, *a*, is formed

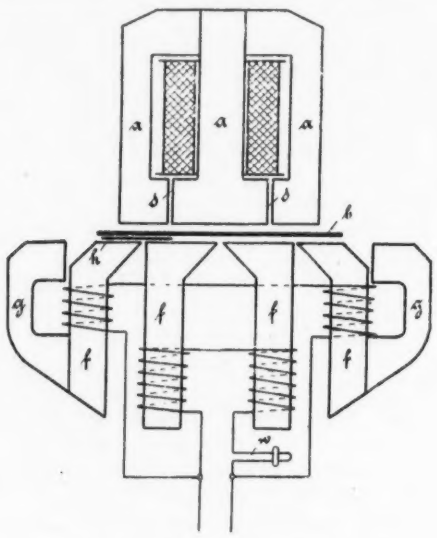


DIAGRAM OF MOTOR METER.

as a choking coil, nearly enclosed in iron. About 90 per cent. of the lines of force of the coils travel through the slots, *d d*, while only a small number pass through the disk-former rotor, *b*. On account of this arrangement the phase difference of the shunt field, which corresponds to the potential, is about 75°, and the component, which effects the movement, is almost just as large as if the phase difference were 90°. The choking coil can stand, with suitable winding, loads up to 250 volts, and wastes hardly one watt. A four-pole main current stator is arranged opposite to the three-pole shunt stator, the two inner poles of which are provided only with coils for a meter for loads free of induction. The construction is such that the secondary shunt currents take place in the main current field, and the secondary main currents in the shunt field. On account of this the action is a very powerful one in spite of the comparatively weak fields. The loss in the main current amounts to about one watt. In the meter for inductive loads all four poles are provided with a coil and the coils on the inner poles act exactly in the same way. The coils of the two outer poles are provided with an iron circuit, *g*. Both windings are connected in parallel, but opposite to each other. The coils on the outer poles generate many lines of force because they are surrounded by an iron circuit, while the coils on the inner pole generate only few lines of force, because large air-gaps are present in the path of the lines of force. Therefore, the current divides itself into two components, one acting for the greater part and one only to a small extent on the disk. On account of this, the resulting main current field can be so arranged that it is vertical to the direction of the shunt field. The exact regulation of the desired phase difference is obtained by introducing into the circuit of the component a small piece of resistance wire, *w*, which can be short-circuited more or less, as desired. By arranging an air-gap of the right dimensions in the path of the lines of force of the inductive circuit, the diagram of the distribution of current over the whole range of measurement is the same, so that the meter gives correct indications with all current values, and any difference of phase in the circuit, where the current is consumed. The loss in the main current windings at full load amounts to about 4 watts. The additional torque, which is influenced by the pressure, is effected by a sheet of aluminum, *h*, arranged movably between the disk and the main current stator. Provision is also made to prevent the instrument from registering when no current is flowing.—*Elek. Zeit.*, July 2.

Friction Losses in Electric Machines.—An article illustrated by diagrams. The author describes a method by which the amount of friction caused by the air and by the journals, can be found separately, instead of being determined together as usual. The method is based on the fact that the resistance of the air varies proportionately to the square of the velocity and the coefficient of bearing friction varies proportionately to the square root of the velocity. Curves are given in the article, showing the values of air and friction losses in the case of a 100-hp, three-phase motor. It was found that the journal friction is far surpassed by the air friction even at a moderate velocity. At 600 revolutions the latter amounted to 1,660 watts, or over 2 per cent. of the effect of the machine.—*Elek. Zeit.*, July 9.

MISCELLANEOUS.

REFERENCE.

Notes on Balata.—TERRY.—The author describes the gathering and further treatment of Balata gum. He thinks that balata has very little application, if any, for insulating purposes, to replace gutta percha. This he thinks is not due to its scarcity, but to its unsuitability, in so far as it contains a large amount of resinous matter, 40 to 50 per cent. being often found in the better quality, whereas the best gutta percha contains only 20 per cent.—Lond. *Elec.*, July 10.

New Books.

STORAGE BATTERY ENGINEERING. A Practical Treatise for Engineers. By Lamar Lyndon, B. E., M. E. New York: McGraw Publishing Company. 382 pages, 178 illustrations and 4 plates. Price, $3.00.

There are few engineers who would not approach the subject of the storage battery with the greatest circumspection. There are several reasons for this. The development of the storage battery in practice is recent. The theory of its action is far removed from the field of electrical engineering, is extremely complicated and imperfectly understood. The manufacture of the storage battery has been hedged about with an almost impenetrable fence of secrecy, and its history is a history of patent litigation.

Therefore, when a book on this subject appears it is likely to be merely an agglomeration of advertising pamphlets, or else it has been rigidly censored by one or another of the manufacturing companies. Such engineering data as have been published are out of date—not because of any rapid strides in development and design, but were antiquated at the time they were issued to the interested public.

The book before us, "Storage Battery Engineering," by Lamar Lyndon, is a delightful departure in this field of engineering literature. It is the most important work that has been written on the storage battery, and is of vast interest to any one who has to do with this useful piece of electrical apparatus. In this volume the subject has been treated in a concise and clear manner. The data are accurate and modern, and the formulæ deduced in a manner logical and inceptive. There are one or two very ingenious mathematical examinations, particularly the problem of the line batteries on page 348. There has been, so far as we know, no adequate solution of this perplexing and important application. Line batteries have been installed according to the dictates of experience, and the result has often been wasteful in energy and lacking in results. Of course, this formula, like all formulas, must often be modified by practical conditions, but its solution is a maximum toward which the result of the actual installation must approach as closely as the conditions will allow.

As Mr. Lyndon tells us, this book was written around a very interesting series of articles on "Storage Battery Auxiliaries" that appeared in the ELECTRICAL WORLD AND ENGINEER some time ago. We have several times had occasion to make use of that work, and the elaboration of the inquiry which appears in the book will be found of use and value.

The treatment of the general subject is well developed. The chapter on general theory is valuable insomuch as it does not pretend to go into an extended and useless discussion of the chemical action of the storage battery. Such a discussion could only be theoretical and perplexing, and belongs more properly to the realms of chemistry. Whether the molecule of lead possesses six or twenty-six atoms, the action of a storage battery at the point of fuel charge is not in the least effected thereby, and the engineer needs to know only enough of the interior action to give him a reasonable grasp of the anatomy of the creature he seeks to train—enough to physic it when sick and mend it when broken. If he wants to go further, he must use a microscope, and the probabilities are ten to one that he will arrive at results reached before by no one else.

What we require to know is not how a given action takes place. We must know briefly what takes place or what may take place, and this information Mr. Lyndon gives us. The subject of the battery proper is broken up into several heads of voltage, active material, electrolyte, internal discharge, influence of temperature, capacity, resistance and efficiency.

We believe that 80 per cent. commercial efficiency is too high a figure. We should prefer to use 75 per cent. watt-hour efficiency for storage, where discharge begins, at or near the end of charge. A battery on regulation service usually works at an efficiency of between 85 and 90 per cent. A new battery, in proper working order, will, of course, give a different figure from one that has been in service some time, and is, therefore, likely to contain more or less sulphating loose active material, etc., etc. Efficiency varies also between types of cell, as does ampere-hour efficiency—particularly the latter. But both watt-hour and ampere-hour efficiency are inextrably tangled up with capacity and life, so that often mechanical strength with low capacity is preferable to high capacity and short life. Every particular problem, however, has its own solution.

An interesting chapter on diseases and their remedies is given, and one on care and management. Somehow a storage battery seems to require a particular kind of genius to nurse it through its many vicissitudes. Its diseases are often so masked and hidden behind myriad phenomena that brains and experience alone is the proper antidote. A storage battery does not, like a generator or engine, cry out when in pain; it will stand a dreadful amount of ill use in silence, and this very silence is often the cause of an engineer's undoing. The battery will stagger along away from sight, hidden securely in some out-of-the-way nook, where it was placed because the space was so inaccessible that nothing else would fit. And then of a sudden it begins to lose its charge, it won't keep its voltage, it does a thousand peculiar things—the engineer cusses it up hill and down dale, the owner catches the infection, and then out goes the battery, and up go the coal bills. A storage battery requires as much —even more—care, than is given to the engines or to the generators. It is a mistake to believe that a battery may be added to a plant and then be left alone. It is often worth its weight in gold when intelligently and properly handled. Otherwise it is worth the price of scrap lead.

Probably the most interesting part of storage battery engineering and consequently the most interesting chapters of the book are those on switches, booster systems and other auxiliary devices so necessary for the operation of the battery. The design of boosters is a particularly interesting and difficult branch of electrical engineering. For troubles and crankiness a booster is as bad as a rotary, and its important relations to battery operation make proper design imperative. Ample material, large cross-sections, heavy commutators, well-designed brushes—these are the first requirements. The field of experience that a reading of storage battery engineering displays speaks worlds for Mr. Lyndon's work.

Directory of Electrical Societies, Etc.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, C. J. Reed, 929 Chestnut Street, Philadelphia; Pa.

AMERICAN ORDER OF STEAM ENGINEERS. Secretary, Frank C. Rose, 10 Federal Street, Pittsburg, Pa.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, 95 Liberty Street, New York.

AMERICAN STREET RAILWAY ASSOCIATION. Secretary, T. C. Penington, 2020 State Street, Chicago. Next meeting, Saratoga Springs, N. Y., September 2, 3 and 4, 1903.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, W. H. Johnson, Philadelphia, Pa. Next meeting, Thousand Islands, N. Y., September 8, 9 and 10, 1903.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, Colby and Abbott Building, Milwaukee, Wis. Next meeting, Indianapolis, Ind., third Wednesday in June, 1904.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, C. H. Mortimer, Toronto, Ont. Next meeting, Hamilton, Ont., 1904.

ENGINE BUILDERS' ASSOCIATION. Secretary, F. P. Ide, Springfield, Ill.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Wm. J. Davis, Ithaca, N. Y.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, Atlantic City, N. J., September 2, 3 and 4, 1903.

INTERSTATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. M. Coleman, Louisville, Ky.

IOWA TELEPHONE ASSOCIATION. Secretary, C. C. Deering, Des Moines, Iowa.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, Ernest H. Davis, Williamsport, Pa.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, Utica, N. Y.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 114 Liberty Street, New York.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary, T. R. Mercein, 85 Michigan Street, Milwaukee, Wis.

SOUTHERN INDIANA TELEPHONE ASSOCIATION. Secretary, E. W. Pichardt, Huntingburg, Ind.

THE ELECTRICAL TRADES SOCIETY (Member National Electrical Trades Association). Secretary, A. P. Eckert, 39 Cortlandt Street New York. Board of Directors meets second Friday of each month

Municipal Electricians.

The Association of Municipal Electricians which will hold its next meeting September 2, 3 and 4 at Atlantic City, has chosen a delightful spot for its convention. In going to the Hotel Rudolf, it is enabled to hold its transactions in the hotel itself, containing 450 rooms and fronting the ocean. Special rates are to be made for the meeting, and a large attendance is expected.

American Street Railway Association.

The twenty-second annual meeting of the American Street Railway Association will be held at the Grand Union Hotel, Saratoga Springs, New York, Wednesday, Thursday and Friday, September 2, 3, 4, 1903. Papers will be presented on the following subjects: "Steam Turbines," "Electric-Welded Joints," "The Evils of Maintenance and Champerty in Personal Injury Cases," "Train Orders and Train Signals on Interurban Roads," "Freight and Express on Electric Railways," "The Manufacture and Distribution of Alternating Cur-

rents for City Systems," "Comparative Merits of Single and Double-Truck Cars for City Service," "The Right of Way."

The headquarters of the association will be at the Grand Union Hotel. The annual dinner will be held at the Grand Union Hotel, Friday evening, September 4, when the officers-elect will be installed.

Additional interest is given to the occasion by the fact that not only will the Street Railway Accountants' Association hold its meeting at the same time, but the first annual meeting will be held of the new American Railway Mechanical and Electrical Association formed last year at Detroit. A very large and fine exhibit of street railway apparatus is expected. The usual rules as to one-and-one-third railway fares will apply.

Duplexing Trains on a Single Track.

By Philip K. Stern.

Multiplexing a railway would perhaps not be quite as intelligible to those familiar with the same term in its application to telegraphy, though its significance is applicable in transportation, as well as in the communication of intelligence. The writer presents herewith a system involving the principles whereby a line of railway may be at least duplexed. The accompanying photographs represent a model of two electrical cars adapted to duplex traffic over a single line of railway, and the objective system is designed to be operated as an amusement feature at seaside resorts, railway parks and the like.

The linear dimensions of the model car are approximately 1-15 of that of the equipment, which they represent, or of a scale of about ¾ of an inch to the foot; the model approximates these proportions in some respects, though in others the dimensions are quite disproportionate, and as a result the models are excessive in weight. The photographs (Figs. 1 and 2) show the two cars as they move upon the same track, and in opposite directions, pass each other by one of them changing its plane.

Fig. 3 illustrates the manner in which one of the cars remains upon the main track, while the other takes a superimposed position in passing over a vertical switch, and is returned to its original plane after conjugation. The model is constructed so as to operate continuously on a track 16 ft. in length, and is provided with means for reversing the direction of the cars as they reach the terminus of the road. Pneumatic buffers are disposed over the roadbed at the terminals to take up the impact due to the inertia of the conveyances.

Since the running gear of the model cars was not designed on

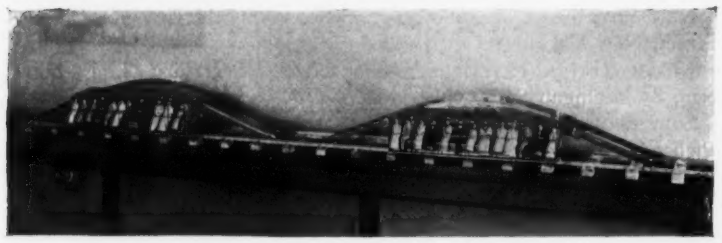


FIG. 1.—TWO CARS APPROACHING EACH OTHER.

engineering principles and was appropriated to toy electrical railways, complete data as to the performance of a system of this character designed on the principles of present practice could not be readily attained. The dimensions of the model, however, may be of interest, and are as follows:

The running gear is of the single truck girder type, modeled somewhat on the lines of the modern electric motor four-wheel car-truck. The length of the wheel base is 9 inches, and the traction wheels two inches in diameter of the double-tread type, with a central flange adapted to run on two different gauges, the larger gauge of 4½ inches involving one of about 3½ inches. The wheel tread is about ⅜ of an inch in width, and fits the gauge of the rails to within ⅛ of an inch, 1/16 of an inch being allowed on opposite treads for end play, as an adjustment for inequalities in the gauge of the track as well as for slight curvature. Upon each of the traction wheel axles, a single reduction gear of 96 teeth is mounted, meshing into 13-toothed pinions carried by the armature shaft of the motors. The latter are of the series wound rear suspension type weighing 2 pounds. The speed of the armature shaft without load is about 1,200 r.p.m.

When the cars are running at normal speed or approximately 150 ft. per minute, the motors consume about 24 watts at about 6½ volts, and during the operation of the cars at the speed stated, the current consumption appears to be approximately 48 watts per car. The weight of the cars, including figures, is a trifle under 12 lbs. The amount of current consumed as one car is moving over the other is slightly in excess of that taken up by the motors when running on a level, but the current falls off considerably at the instant the superimposed car leaves the gradient and is running down grade to the main track. In this connection it appears that the total work done by the six cells of accumulator employed to drive the two cars is

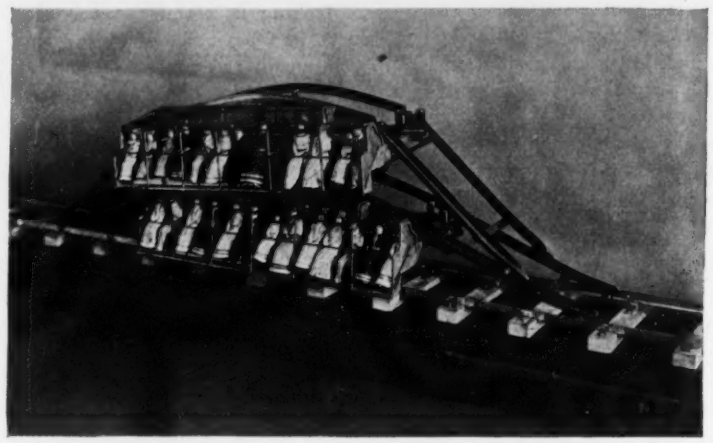


FIG. 2.—CARS "PASSING."

about the same as that when the cars are going over the gradient or running on the level.

Four motors, two for each car, are connected up in multiple arc and make an electrical rolling contact through the wheels with the track which is likewise connected in multiple arc with the storage battery. A section of each terminal of the track extending for about 33 inches toward the center is insulated from the remaining portion of the track by open spaces, and the two sections are cross-connected in series; it is the terminals of each of these sections that are provided with pneumatic buffers.

The superstructure of the cars comprises an overhead switch above referred to, registering with the narrow-gauge system of rails and the inner tread of the traction wheels. This consists of a sinusoidal

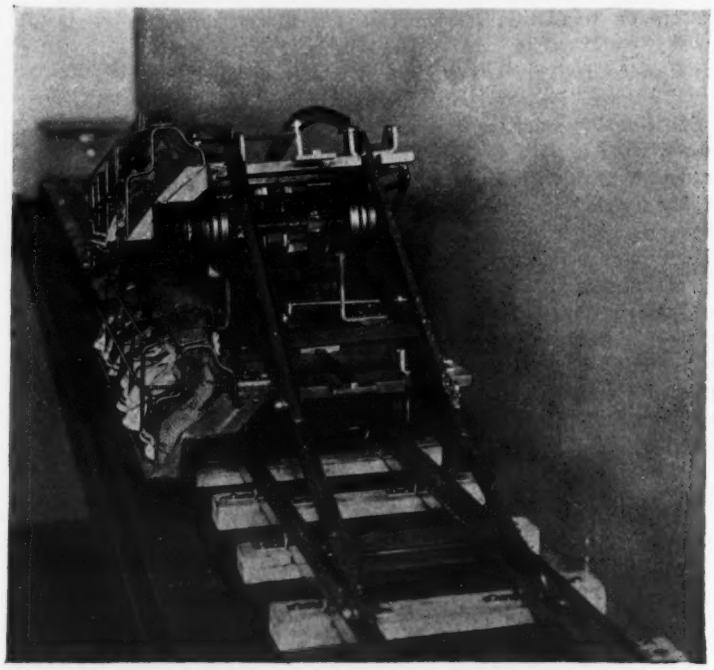


FIG. 3.—CARS "PASSING."

curved track supported by columns from the car sill, so as to elevate the summit of the grade 4½ inches above the roadbed. A chord of this curve, 16 inches in length trisects it so as to cut off from both the extremities about 8 inches of the inclined ends. These are

jointed to the extremities of the crest of the curve by gimbals carried by the car sill. These jointed portions serve the purpose of respectively pilots on the one hand to guide a mounting car when it strikes the overhead switch, and on the other hand, as skids when the superimposed car is descending the gradient of the subtended vehicle. The total length of the superstructure or overhead switch is 34 inches, thus the average grade is approximately 25 per cent.

Electrical communication between the superstructure and the main track is effected by a rolling contact between the jointed extremities or pilots of the bridge work through double-treaded pilot wheels measuring ¼ of an inch in diameter at the tread and ⅜ inch extreme. These revolve on axles ⅛ by ½ inch secured to brackets carried by the pilots. At the instant of conjugation of the two cars, the mounting pilots which are permanently elevated above the plane of the subtending pilots of the opposing car, take the gradient and establish electrical communication between the superstructure of the subtending car through the pilots and motors of the one mounting.

A remarkable feature in the operation of the model may be here mentioned, and that is the apparent jumping of one car over the other when they are brought into apposition from a state of rest; as soon as the battery switch is closed and the current is turned into the track, the mounting car immediately climbs the gradient of the subtending conveyance at approximately a normal starting speed.

Electric Automobile Chairs for St. Louis Exposition.

Electric automobile chairs will be one of the features of the World's Fair at St. Louis in 1904, Semple S. Scott, of St. Louis, having recently obtained the concession to operate them during the Exposition period. The chairs, which are the invention of Mr. Scott, will have a uniform speed of three miles per hour, the operator having no control over the speed. The same rate is maintained uphill, downhill, or on the level. The chair takes the form of a low phaeton without a cover. There are two large rear wheels and two small ones under the foot rest. All are pneumatic-tired. The seat is upholstered in cane like the seats on street cars and in summer railway cars. Behind the seat is a box which contains the batteries

ELECTRIC AUTOMOBILE CHAIR.

to operate the machine. If two visitors desire to occupy the chair and the service of a guide is wanted, the latter can sit on an adjustable seat at the rear.

On the inside of the chair, attached to the arm, is a lever, which puts the chair in motion or stops it at the will of the rider. A long lever attached to the front truck has its handle directly in the center of the chair within easy reach of the driver. A gentle pressure guides the machine in the desired direction. A feature of the machine is a "sensitive rail" which surrounds the chair on all sides save at the rear. This prevents any accidents, for when the rail comes in contact with any object, even though it weighs but a pound, it presses against a device that locks the wheels and brings the chair to a dead stop.

General Electric's Exhibit at Detroit.

The General Electric Company occupied the largest space in the Light Guard Armory, where the electrical exhibition was held during the convention of the National Electrical Contractors' Association at Detroit. The space was brilliantly illuminated by Meridian lamps of both 120 and 60-watt sizes. Display boards of miscellaneous supplies, including the new enclosed fuses, were shown. A comprehensive line of small motors were shown in operation, in-

GENERAL ELECTRIC COMPANY'S EXHIBIT.

cluding alternating and direct-current sewing machine outfits. A number of the company's convertible type fan motors were to be seen as well as some of the small exhaust fans. An interesting collection of portable and pocket instruments was also displayed. The entire space was handsomely decorated with palms and smilax and comfortable reception quarters, characteristic of the General Electric Company's recent exhibits, were provided. Those in attendance were J. H. Livsey, Detroit; P. L. Clark, Chicago; W. H. Hand, St. Louis, and F. H. Gale, Schenectady.

Development of National Steel Foundry Interests at New Haven, Conn.

The National Steel and Wire Company, with its customary progressiveness, has taken active and successful steps to associate with it as a subsidiary company, the new National Steel Foundry Company, recently organized by prominent local interests in New Haven. This move should prove of the greatest mutual advantage, for with a large and varied line of the finest steel castings to add to the present production of all kinds of high-grade specialties in rods, wire, wire fencing, wire rope, telegraph and telephone wire, etc., the National Steel and Wire Company can reasonably expect a greatly increased volume of business. The National Steel Foundry Company, on the other hand, has been able to purchase a part of a most advantageous 50-acre site owned by the National Wire Corporation (also a subsidiary company of the National Steel and Wire Company), having both railroad connections and dockage capable of accommodating ocean-going steamers of large tonnage. Furthermore, the Foundry Company will be able to re-melt in its open hearth furnaces all of the waste from the wire and rod mills of the National Wire Corporation, and thus much of the scrap necessary to make steel castings will be always provided for and freightage thereon saved. The National Steel Foundry Company was originally organized to supply the trade of New England and New York, throughout which section there has been the greatest scarcity of steel castings. This union of interests, however, immediately opens the broadest possible field, as the National Steel and Wire Company maintains selling departments in Chicago, Kansas City, San Francisco, and De Kalb, Ill., as well as in Boston, New York and New Haven.

The capital of the National Steel Foundry Company is $300,000, and the plant which is being erected is in every way up-to-date and thoroughly equipped to turn out 35 tons of finished product per day. The main building, which will contain the moulding and casting de-

partments, is 408 ft. long by 160 ft. wide, with two 25-ton acid open-hearth furnaces of 25 tons capacity each, and one 40 and three 30-ton traveling cranes. Aside from this the necessary pattern storage, power house and gas producers will be erected immediately. All the buildings are so arranged as to permit of ready extensions from time to time as an increased business may require. It is confidently expected to pour the first heat by January 1, 1904.

The directorate consists of Henry L. Hotchkiss, president, L. Candee & Co.; president, Union Trust Company; president, Shoe Hardware Company; president, New Haven Web Co., etc.; Frank L. Brown, vice-president and treasurer, National Steel and Wire Company; H. Sanborn Smith, vice-president and secretary, National Steel and Wire Company; Frederick B. Farnsworth, president, McLagon Foundry Company; treasurer, Eastern Machinery Company; H. Stuart Hotchkiss, vice-president and secretary, L. Candee & Co.; Eugene Buckman and M. Sims, of New Haven. The officers are Henry L. Hotchkiss, president; Frederick B. Farnsworth, vice-president; H. Stuart Hotchkiss, treasurer; Eugene Buckman, secretary; M. Sims, manager. The company has issued a very interesting little pamphlet on the art and uses of steel castings.

Automatic Switches.

The General Incandescent Arc Light Company's experience with automatic switches in the last three years has demonstrated that such a switch can be made and can be installed with the assurance that it will give absolute satisfaction under the most severe conditions incident to any service to which they may be applied. These switches are made either one, two or three-pole, for service on voltages up to and including 250 volts, and to carry currents up to 200 amp., as shown in the accompanying cut herewith.

The demand of the day, however, has necessitated the design of larger capacity switches for these voltages, and the above company has now installed automatic switches, which are designed to carry continuously as much as 2,500 to 3,000 amp. Naturally the design for the larger size switches is different from that of the smaller size, and they are so made that the amount of current that can be handled is not limited within any commercial requirement.

In these days when central stations are being almost exclusively equipped for automatic remote control of all the apparatus, it is not surprising that similar applications are being made to other generating plants. Switches for the latter are of the smaller size and are specially suited to installations where it is desired to cut the entire lighting system of a building or a house by the mere pushing of a button, from one or more points distant from the switch. It is very desirable to have the lighting system cut off from the street service in case a building gets on fire, and by some it is considered equally desirable to cut the entire lighting systems off from a residence in case of a thunderstorm, or during the night.

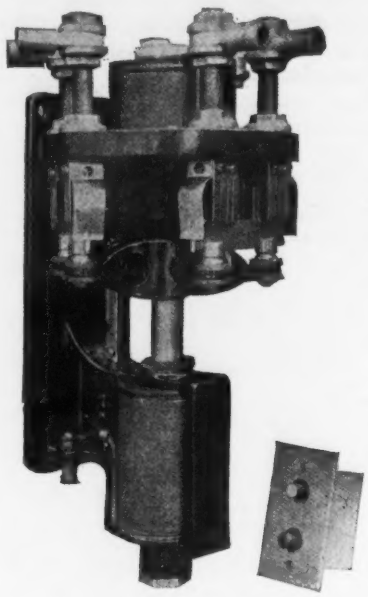
These instances are only a few of the cases where individual switches could be installed to great advantage, but too much stress cannot be laid on the fact that in lighting large public bulidings, such as the sky-scrapers that daily shoot up in New York City, enormous savings could oftentimes be made in the cost of wiring and the labor of installing it, by the use of automatic switches placed throughout the building. In one case it was estimated that $20,000 could be saved by using automatic switches of this kind, instead of following the usual methods of wiring.

In central stations, of course, the use of automatic switches is almost indispensable, especially in the case of a high-tension plant, where the apparatus is designed for remote control. In such plants the low-tension exciter systems oftentimes can be installed with low-tension automatic switches to great advantage, thereby carrying out the general scheme with consistency and at a considerable saving in the original cost.

Automatic switches have been used to great advantage in connection with other devices, such as pressure gauges, which are so arranged that when the pressure becomes excessive in any receptacle into which air or water is being forced by a motor, the pressure gauge closes a contact at such a time, opening the automatic switch and thereby stopping the motor.

The few instances here noted show that the application of an automatic switch such as is here illustrated, is almost limitless; and perhaps the reason why they have not been more often applied is that manufacturers in attempting to produce an article that can be sold at a low price, have been content with a design so light and flimsy that it would not stand up and do the work for which it was intended.

These "G. I." automatic switches are built on an iron frame, which is very substantial and strong, and which also serves to produce a strong magnetic field for the operating solenoids, as will be seen



AUTOMATIC SWITCH.

by a glance at the illustration. The switch is intended to be used in a vertical position, so that gravity tends to open it. The opening of the switch is accomplished by a hammer blow, the core in the lower solenoid having lost motion, which is thus taken up before the burden of opening the switch is thrown upon it. This insures the switch opening at all times, as a large factor of safety is thereby introduced.

New Cable Car for Linemen.

A new design in cable cars, which provides a table on which an electrician can lay his tools and material while making a splice, has been appreciated by all who have seen it. The cable car is the one made by the F. Bissell Company, Toledo, Ohio, as shown in the accompanying illustration. This car consists of one continuous piece

LINEMAN'S CAR.

of pipe without joints except where the short end of pipe is attached at the trolley. The trolleys are of malleable iron, are very light and unbreakable, but still very strong.

The seat is of wood, dove-tailed to prevent warping, and can be adjusted up or down or to the right and left to suit the size and convenience of the man using it. The table has been added without any addition to price. These tables can also be attached to cars of this make already in use.

Electrical Equipment for Chilean Nitrate Plants.

A complete electrical equipment has been ordered for installation in one of the largest Chilean nitrate plants, and orders for two other outfits will be placed by J. K. Robinson, of Iquique, Chile. The Westinghouse contract, just placed, calls for a 130-kw. plant. There will be an 85-kw. engine type generator, direct connected to a 11-in. by 19-in. by 11-in. compound condensing engine; also a 45-kw. generator direct connected to an 8-in by 13-in. by 8 compound condensing engine. The boiler capacity will be of 375 hp. in three units. Two will be of Babcock & Wilcox manufacture, and the Stirling Company secured the order for the third unit. There will be fifteen Westinghouse motors varying in capacity from two to 40 hp. Eight pumps, to be electrically operated, have been ordered from the Goulds Manufacturing Company, to have a capacity of from 3,000 to 15,000 gallons per hour.

The equipment is intended for the Oficina Victoria, a British concern, which operate extensive nitrate deposits near Iquique. The plant is to be built at Junin, the principal port for the nitrate export.

Two Baldwin-Westinghouse electric locomotives have also been ordered, to be used for hauling the nitrate at the port. These engines will mark the introduction of American electric ones on the west coast of South America. The trolley wire, feeders, etc., have been ordered from the Standard Underground Cable Company.

Automatic Gear Cutting Machine.

Hardinge Brothers, Chicago, have added to their extensive line of machine tools a gear-cutting machine thoroughly adjustable and capable of doing the most accurate work with the greatest rapidity.

All of the movements of the machine are positive and follow each other as closely as possible, thus avoiding lost time. The index plates are interchangeable; separate ones are used for each number of teeth, for it is considered that any job worth putting into an automatic gear-cutting machine is worth providing with a special index. The spacing half of the index plate is enclosed within a case,

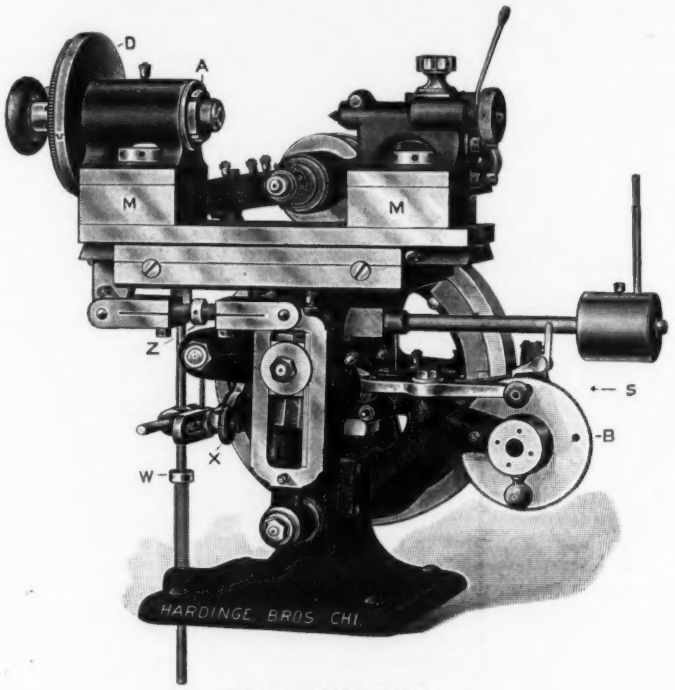


FIG. 1.—GEAR CUTTER.

D, which prevents any dust or dirt from getting into it; and it is revolved by the exposed half of the index plate, being parted below the bottom of the spacing notches. The raising blocks, *M M*, are by ½-in. steps. The spindle can be raised and lowered ¾ in., thus covering all sizes of work. Fig. 2 shows the divided hand nut, *H*, reading to thousandths of an inch.

The side movement for getting the cutter central is accomplished by loosening four screws on clamp, *G*, and revolving the cutter spindle bracket bearings, *I*. This moves the entire cutter spindle and bracket to the right or left, but does not alter the adjustment or solidity of the spindle bracket bearings. The front end of the bracket has hardened bushings fitted at *J*, which pass over a tempered parallel arbor and require no care or adjustment while moving the cutter to the center with spindle.

The indexing arrangement is simple and positive and has every adjustment required, whether fine or coarse. Every revolution of the main wheel, *U*, cuts one tooth; about 7/16 of the time is used in spacing and 9/16 in cutting. This movement is irregular in speed, according to the changing of the fulcrum of the bracket. The main slide travels faster when the crank pin or bolt is nearest the bottom, or when the cutter is disengaged, although when the cutter is in action the variation of the cutting feed is not perceptible.

An adjustment for spacing is provided by the sliding nut, *X*,

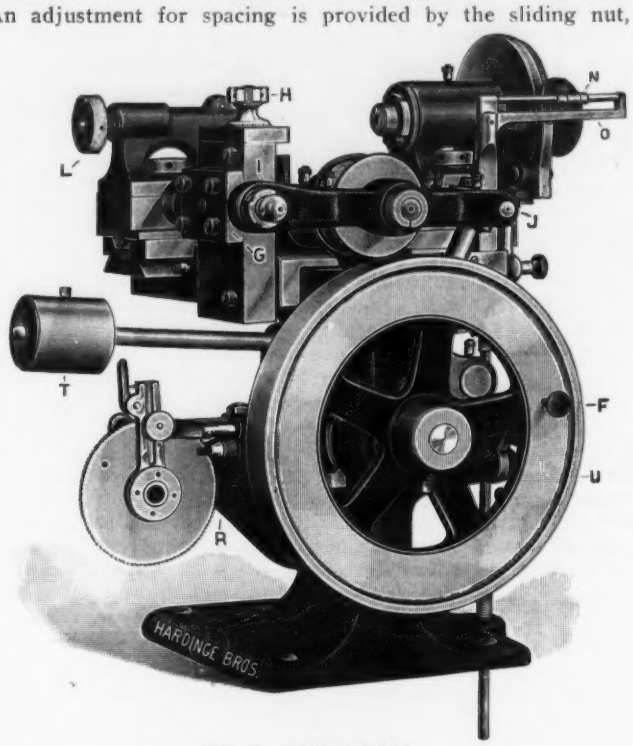


FIG. 2.—GEAR CUTTER.

and also by a screw, *F*, which raises or lowers a cam. This cam comes in contact with the roller wheel, *K*, when a retaining latch is raised out by a clip. The adjustment for time is given by moving a simple device in or out of the frame to the exact position in time with the spacing cam, the stroke of the main slide, and the cam which raises and lowers the cutter spindle and bracket.

The weight, *T*, regulates the tension of the belt for the cutter, thus keeping a contact with the main cam, which raises and lowers the cutter by use of the rod at *J*. Thus, when the slide is about to return, this cam on the main shaft lowers the cutter out of the tooth, allows the spacing, and returns the cutter to position at the end of the stroke. This main cam also acts in connection with the automatic stop for the cutter, *R*, though it does not affect the spacing mechanism. This will be understood from Fig. 1, with reference to the ratchet, *B*, showing the hole in same. Every revolution of the main wheel, *U*, which revolves the main cam that raises and lowers the cutter, also works the ratchet, *S*; and as this ratchet coincides with the index plate spacing, it will move tooth for tooth. As the hole, *B*, passes under the lever shown under the ratchet click, *S*, this lever drops into *B* and disengages the main cam, thus stopping the raising and lowering of the cutter, and also the indexing of this ratchet wheel with the hole, *B*. It does not, however, stop the revolution of the cutter spindle or the main index plate. This method keeps the cutter spindle at a positive temperature, and avoids any trouble in spacing from the expansion or contraction of the metals in the spindle and machine under varying temperature.

The head spindle has a ball bearing thrust at *A*, which enables the use of a variable tail stock pressure, but does not affect the turning of the head spindle or the indexing. Any desired stroke can be given to the slide by the movable crank pin or bolt, thus effecting a great saving of time; and the adjustment of the head position obtained by means of the right and left-hand bolt, *Z*, which can be securely locked. Every provision is made for adjustment for wear, and the oiling devices are the most complete. The cutter spindle and bracket spindle are hardened and ground. The head spindle has hardened and ground chuck socket and ball race. The cutter spindle revolves in phosphor bronze adjustable journals.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—Time money showed a tendency towards easier conditions, and a business of moderate size was done. The closing rates were 4½ to 5 per cent. for 60 to 90 days and 5 to 6 per cent. for four, five and six months. The stock market was dull but steady, at a recovery in the decline resulting from the recent failures and the attending enforced liquidation of collaterals. There was a good deal of investment buying by bargain hunters, and large interests were understood to have given support to various specialties, the strength of standard stocks being particularly noticeable. Some irregularity, however, was caused by declines in specialties and neglected industrials, owing to the disfavor with which such issues are regarded in connection with loans. All of the electric and traction stocks showed greater activity and improvement, with one exception, this being Westinghouse preferred, which dropped to 165—representing a net loss of 5 points on the week's trading. Westinghouse common made a net gain of 4 points, closing at 170—the extreme prices being 160, the lowest, and 172½, the highest. Nine hundred and twenty-five shares of this stock were sold. General Electric showed some firmness, rising from 153, the lowest, to 163½, the highest, and closing at 162, a net gain of 5 points. Western Union closed at 84, being ¾ of a point gain. American Telephone & Telegraph closed at 131½, which was the ruling price throughout the week, and 1½ points net gain. Brooklyn Rapid Transit was active, 43,143 shares having been sold. It closed at 45¼, thus gaining 3¾ points. Metropolitan Street Railway made a gain of 6 points, the closing price being 119, the highest and lowest quotations being 121 and 112, respectively. Manhattan Elevated closed at 132¾, being a gain of ⅜ of a point. Following are the closing quotations of **August 4:**

NEW YORK.

	July 28.	Aug. 4		July 28.	Aug. 4
American Tel. & Cable	77	77	General Electric	162	157
American Tel. & Tel.	131	130	Hudson River Tel.	..	..
American Dist. Tel	25	25	Metropolitan St. Ry.	117	116½
Brooklyn Rapid Transit	44¾	42⅛	N. E. Elec. Veh. Trns.	..	..
Commercial Cable.	..	149	N. Y. & N. J. Tel.	..	..
Electric Boat	15	15	N. Y. E. V. T. Co.	4⅛	4⅜
Electric Boat pfd.	35	35	Tel. & Tel. Co. Am	..	..
Electric Lead Reduction.	1⅜	1⅜	Western Union Tel.	83½	83⅛
Electric Vehicle	6½	5	Westinghouse com.	171	163
Electric Vehicle pfd.	8	8	Westinghouse pfd.	172	165

BOSTON.

	July 28.	Aug. 4		July 28.	Aug. 4
American Tel. & Tel	113¼	130	Western Tel. & Tel. pfd.	80	83
Cumberland Telephone	..	..	Mexican Telephone	1⅛	1⅜
Edison Elec. Illum.	237½	..	New England Telephone	124	120*
General Electric	164⅜	..	Westinghouse	..	85
Western Tel. & Tel	12	13	Westinghouse pfd.	..	85

PHILADELPHIA.

	July 28.	Aug. 4		July 28.	Aug. 4
American Railways	..	..	Phila. Traction.	94½	94⅝
Elec. Storage Battery	52	57	Phila. Electric	5⅝	5⅛
Elec. Storage Battery pfd.	..	58¼*	Pa. Electric Vehicle	..	..
Elec. Co. of America.	7⅛	7¾	Pa. Electric Vehicle pfd	..	..

CHICAGO.

	July 28.	Aug. 4		July 28.	Aug. 4
Central Union Tel.	..	..	National Carbon pfd.	90	90
Chicago Edison	147	142	Northwest Elev. com	..	..
Chicago City Ry	170	165	Union Traction	4	3¼
Chicago Tel. Co	..	120	Union Traction pfd.	30	30
National Carbon	21	23*			

*Asked.

ELECTRIC ELEVATED EARNINGS.—It is stated that earnings of the Boston Elevated are showing up handsomely. For June and July gross earnings will be well over $1,000,000 per month. June this year was a poor riding month, and compared with a good month last year, Boston Elevated gross earnings amounted to $1,040,000, and during that month there was a total of 3,987,000 car miles run as compared with 3,958,000 car miles run in June, 1902. For nine months of the Boston Elevated Company's 1903 fiscal year, there was a total of 35,158,000 car miles run, as compared with 33,774,000 car miles for the same period the previous year. The earnings of the Manhattan Elevated are increasing $4,000 per day, as compared with last year, and the outlook now is that the company will earn 10 per cent. this fiscal year, making a very handsome surplus to go to the lessees, who have put up $4,000,000 to secure the Manhattan's lease rental. Brooklyn Rapid Transit earnings are making larger gains than Manhattan. For the first 25 days in July, Brooklyn Rapid Transit gained $161,000 over corresponding period a year ago. The 26th day being a good Sunday, there was the astonishing record of a $13,000 gain for one day over a year ago, making the average gain for the 26 days above $6,000 per day. The company is earning more than 4 per cent. upon its share capital. Earnings for the first six months of the Chicago Metropolitan Elevated of this fiscal year promise to be the largest in the history of the road. This is due partly to the good traffic and also to large economies. The road will earn fully 2 per cent. for the six months. The traffic on the Aurora line and the Suburban Electric line is unusually heavy. Last fiscal year the company earned $10,000 over 3 per cent. after paying $45,000 extra for coal, besides meeting other unusual expenses, which would have brought the earnings close to 4 per cent. for the year.

BOSTON EDISON EARNINGS.—The business of the Boston Edison Electric Illuminating Company in the fiscal year ended June 30 was very satisfactory. After charging off an increase of from $70,000 to $80,000 in cost of coal over normal years, the surplus, after dividends, was practically the same as that of a year ago, which was $116,098. The company does a gross business of about $2,500,000. During the past year the company increased its capital $1,570,200 by the issue of 7,851 new shares at $200 a share, making its present capital stock outstanding $8,635,500. Mr. J. P. Morgan is the largest individual stockholder in the company, being credited with 3,099 shares.

BIG TRACTION COMBINATION.—According to the Los Angeles *Times* a large holding company may be organized within six months to merge all the interurban electric lines tributary to Los Angeles with a capital of $50,000,000, as hinted at when Huntington secured a vital interest in the Los Angeles Traction Company through its purchase by the Southern Pacific interests. It is possible with the organization of a holding company that Messrs. Clark and Sherman, with their extensive interurban interests to Hollywood, Santa Monica and other points, will join with Messrs. Huntington and Harriman.

CAPITAL STOCK INCREASES.—The capital stock of the United Electric Light Company, of Springfield, Mass., has been increased from $600,000 to $800,000. The capital stock of the Hudson River Telephone Company has been increased from $4,000,000 to $5,000,000.

ELECTRIC STORAGE BATTERY.—It is stated that the net earnings of the Electric Storage Company for the six months ending June 30 were $1,200,000, the largest for any similar period in the company's history.

Commercial Intelligence.

THE WEEK IN TRADE.—Seasonable conditions prevail in trade, though, as *Bradstreet's* points out, an irregularity and weakness in some staple prices reflect readjustments proceeding from enlarged production. A seasonable volume of trade in the Northwest is indicated by late advices. The corn crop in the Middle West and Southwestern States has been improved by much-needed rain, and in the Northwest prospects for a fair to good spring wheat crop are still noted. Returns from the winter wheat harvest are, however, less satisfactory. Cotton crop reports are quite as favorable as at any previous time, rains in the Gulf States having proved beneficial. Iron and steel buyers are still backward, and this trade is affected sympathetically by the decline in the stock market. The industrial situation is improved. The railroads are having all they can handle, and talk of congestion is again heard. Many thousand building hands have resumed work at New York, though some unions still persist in holding out. Copper was inactive and weak. The leading sellers are quoting a price about ¼c. per pound under the quoted rate of 13¼c. for Lake and electrolytic, as named by the metal exchange. Prices are about ⅛c. lower. The closing "official" prices are 13¼c. for Lake and electrolytic, and 12¾ to 13c. for casting stock. There were, during the week ending July 30, 190 business failures, according to *Bradstreet's* summary, against 183 the previous week, and 168 the corresponding week last year.

THE EDISON STORAGE BATTERY.—Last week Mr. Edison was quoted here as to some recent tests of his battery. He also said in a recent interview about it: "We cannot put the new battery on the market in any quantity as yet. The best we can do now is to make one a day. By October we will make at least six daily, and about Christmas we will be in shape to meet any demand. The trouble has been that special machines had to be built, but the last of these will be completed next week. Another disadvantage I have to contend with is paying 40 per cent. duty on a certain sheet steel

that must be imported from England or Germany, and then in only limited quantities. By Christmas three rolling mills will be able to make it for me here in this country, and then the present high price for the batteries will be reduced. As to charging stations, in the last month forty-five new ones have been installed in the New England States alone, and this is going on all over the country. Another thing, the battery will be made in four sizes, so that when fully charged it will run 25, 50, 75 or 100 miles, and if wanted they will be made any size larger or smaller. Of course, the running power of the battery will depend to a certain extent on the work it is called upon to do. If the roads are rough and there are many hills, a charge will last a shorter time than if the conditions were such as are found in the city. But taking the maximum of bad going, the battery will only be exhausted about 25 per cent. sooner than it would be under favorable conditions."

HARRISBURG ENGINE CONTRACTS.—Mackenzie, Quarrier & Ferguson, Incorporated, 114 Liberty Street, New York, has secured a contract from the Davies & Thomas Company, Catasaqua, Pa., for a tandem-compound Harrisburg engine of 300 hp for direct-connection to a 200-kw Sprague generator for both light and power. The Pennsylvania Cement Company, of Bath, Pa., has contracted for a 80-hp Harrisburg standard engine for direct-connection to a 50-kw General Electric generator for lighting. The village of Greene, N. Y., is to be furnished with a 90-hp Harrisburg standard engine to be belted to a 60-kw alternating-current Westinghouse generator. The boiler will be built by the Watertown (N. Y.) Engine Company. This equipment is intended for the village lighting plant. The United Verde Copper Company, 59 Wall Street, New York, has requisitioned for a Harrisburg standard engine of 25-hp capacity for direct-connection to a 150-kw General Electric generator, to be used for both light and power in its Jerome, Arizona, plant. The Manufacturers' Foundry Company, Waterbury, Conn., has ordered a 45-hp Harrisburg standard engine for direct-connection to a 30-kw Crocker-Wheeler generator for lighting.

MARION INSULATED WIRE INTERESTS.—The Marion Insulated Wire & Rubber Company, of Marion, Ind., has now well under way its new factory for the manufacture of rubber-covered wires and cables. It will make a full line of such goods, including telegraph and telephone cables, and lead-incased varieties. The factory building is 224 x 60 ft., three stories and basement, 150 x 60 ft., with an L 100 x 40 ft., two stories. The mills and washers will be direct-connected to a 450-hp Corliss engine, and all other machinery will be driven by electric motors, with current from the factory plant. Not anticipating any unusual delay, the management expects to be in operation by November. The officers are J. L. Barley, president; C. A. Michaels, vice-president; Hiram Beshore, treasurer, and R. E. Lucas, secretary and general manager. The latter is well known in the electrical field as being for the past eight years secretary of the Indiana Rubber & Insulated-Wire Company at Jonesboro, Ind. President Barley is the president and manager of the Barley-Spencer Lumber Company, and is associated with a large number of manufacturing enterprises at Marion. Mr. Michaels is also connected with numerous enterprises, is proprietor of the Union Cabinet Company, and is largely interested in the local electric light plant. Mr. Beshore is connected with the Grant Trust and Savings Company. The list of stockholders is not a long one, those on it being all well-to-do people.

THE VOUGHT-BERGER COMPANY, of La Crosse, Wis., has recently sold equipments to the following telephone companies: Farmers' Telephone Company, Jesup, Iowa; Farmers' Mutual Telephone Company, Tonkawa, Okla.; Persia Co-Operative Telephone Company, Persia, Iowa; Steele County Telephone Company for their Geneva and Ellendale (Minn.) exchanges; Farmers' & Merchants' Mutual Telephone Company, for their new exchanges at Le Sueur Center and Lexington, Minn.; Stevens County Telephone Company, a 300-drop board for Morris, Minn., and a 100-drop board for its Cyrus exchange; a 100-drop board for the Electric 'Phone Company, at Stewart, Minn.; Franklyn Telephone Company, Franklyn, Minn.; Barnesville & Wolverton Telephone Company, for its Dibley & Wolverton (Minn.) exchanges; also boards and telephones for Clutier, Iowa; Sheldon, N. D.; Ruthton, Minn.

TELEPHONES IN HOTELS.—The New York Telephone Company, F. H. Bethell, contract agent, reports that contracts have just been closed covering long-distance telephone service in all of the rooms and working departments of the following hotels in New York City: Waldorf-Astoria, 1,250 stations; Park Avenue, 410 stations; Majestic, 350 stations; Netherlands, 300 stations; Albert, 268 stations; St. Denis, 250 stations; Normandie, 100 stations. The work of installing these systems is to be completed this summer. The Waldorf-Astoria switchboard equipment will consist of one seven-position switchboard and two one-position switchboards. No fewer than fifty trunk lines will connect the system with the general exchange system.

JANDUS ELECTRIC COMPANY.—We are pleased to welcome as neighbors the Jandus Electric Company. The Eastern business of this company has increased so rapidly that it has had to seek larger quarters for its New York office. Recognizing the advisability of being at the center of things electrical, the company moved its offices a week or so ago to the Engineering Building, 114 Liberty Street. Mr. Nash, the Eastern manager, is now making his headquarters here. Mr. Organ is to be congratulated upon the growth of the business under his management. We understand that this increase is apparent both in its fan and its arc light business.

MESSRS. F. BERG & CO.'S new hat factory at Orange, N. J., will be run entirely by electricity, an isolated plant now being installed for this purpose. A recent contract with the Westinghouse Electric & Manufacturing Company calls for twenty-seven alternating-current, two-phase motors, twenty of which will be belted to shafting to run the machinery used in the process of making hats; the remaining seven are each to be provided with an extended shaft eight inches long and will be direct-connected to blowers used for collecting the fine felt used in the process of manufacture.

ELECTRIC PUMPING OUTFITS FOR JAPAN.—Francis A. Cundill, 90-96 Wall Street, New York, American representative for the British firm of L. J. Healing & Co., of Yokohama, is in the market for a number of electrically-operated pumping equipments and for installation in Japanese mines, etc. The pumps will be used to lift at the rate of thirty cubic feet per minute to an altitude of 200 ft. They will be mounted on trucks. Three single-cylinder automatic cut-off engines of 65-hp capacity each and two of 125 hp each, will also be purchased.

TELEPHONE EQUIPMENTS.—The Oceana Telephone Company, of Hart, Mich., is installing a 200-capacity generator call visual switchboard of the Stromberg-Carlson make at Hart. The Citizens' Telephone Company, of Grand Rapids, Mich., is installing a generator call visual signal switchboard of 140 lines at Fremont, Mich. The Stromberg-Carlson Company is also installing intercommunicating systems for the following Chicago firms, namely: Brunswick-Balke-Collender Company, Library Bureau, and Brown & Sharpe.

LARGE ANDERSON SWITCH CONTRACT.—The New York Edison Company has placed a contract for station switches, which is claimed to be the largest individual requisition for such apparatus filed. The switches which will be manufactured by the Albert & J. M. Anderson Manufacturing Company, of Boston, are intended for installation in all the various stations of the Edison Company. More than 50 tons of copper will be utilized.

AFTER JAPANESE TRADE.—The Hamburg Commission house, of N. Joachimson, which handles considerable American machinery for shipment, principally to the Far East, is about to engage through the New York offices, 6-9 Hanover Street, the services of a special representative who will proceed shortly to Japan with a view to securing contracts for water power plants and various other electrical equipment and supplies.

LARGE FLOUR MILL TO BE ELECTRICALLY OPERATED.—The Washburn-Crosby Company, 112 Broad Street, is to construct a large plant in Buffalo for the manufacture of flour. All the machinery will be electrically operated. The initial equipment will not be less than 2,000 hp. The boiler contract has already been awarded to the Heine Safety Boiler Company for four units of 500-hp capacity each.

SOME HEINE BOILER CONTRACTS.—The Heine Safety Boiler Company, of St. Louis, has secured the contract for boilers to be installed in the new plant of the East St. Louis & Suburban Railway Company. One thousand horse-power will be put in. There will be four units. Two 350-hp Heine boilers have also been ordered by the Citizens' Light, Heat & Power Company, of Montgomery, Alabama.

THE ASTORIA STEEL COMPANY, Astoria, New York City, expects to be in active operation for the manufacture of steel castings about October 1. It is equipping the plant with the most modern and up-to-date apparatus and will have a capacity of 100 tons a day. Mr. P. J. Ryan, formerly of the Penn Steel Casting Company, is sales manager.

MONTANA CONTRACTS FOR LIGHTING.—The Wagner-Bullock Electric Manufacturing Company has recently, through its district agents, Gilbert Wilkes & Co., Denver, Colo., closed contracts for complete installations of light and power plants with the cities of Bozeman, Lewistown and Dillon, Mont.

LINE MATERIAL WANTED.—The Catawba Power Company, of Rock Hill, S. C., is to begin construction of 29 miles of pole line about September 1 and is now in the market for poles, cross arms, insulators, galvanized braces, bolts, etc. Mr. W. S. Lee, Jr., is chief engineer.

General News.

THE TELEPHONE.

CORONA, CAL.—The Corona Home Telephone and Telegraph Company has been organized to make use of the franchise recently sold by the city to W. M. Niebel, of Long Beach.

DOWNEY, CAL.—P. T. Spencer has been granted permission to operate a telephone system in Los Nietos and Downey townships. A similar grant has also been made to the Covina Home Telephone Company.

SANTA ANA, CAL.—The Home Telephone Company has incorporated here with a capital stock of $100,000, of which amount $10,000 has been subscribed. The directors are F. F. Graves, John Van Liew, F. W. Wachter, Charles L. Zahn and Arthur Wright, all of Los Angeles.

LOS ANGELES, CAL.—The San Pedro Home Telephone and Telegraph Company, of San Pedro, has been incorporated with a capital stock of $100,000, of which amount $5,000 has been subscribed. The directors are Charles T. Sutton, J. C. Brainerd and Don C. Porter, of Pasadena; Charles L. Zahm, of Los Angeles; W. L. Porterfield, of Long Beach.

WAYCROSS, GA.—The Southern Bell Telephone Company has begun the work of improving its system at Waycross and will expend about $15,000.

COLUMBUS, GA.—The Southern Bell Telephone Company has purchased a site for a new exchange building at Columbus, to be used as an exchange for three cities.

ELBERTON, GA.—The Southern Bell Telephone & Telegraph Company is extending its lines out from Elberton to a number of nearby towns. A line to Abbeville, S. C., has been completed.

KEWANEE, ILL.—The Kewanee Home Telephone Company has been incorporated with a capital stock of $125,000. Among the directors is J. L. Dunn.

SCOTTSBURY, IND.—The Scott County Telephone Company operates an American 200-drop board.

NEW ROSS, IND.—The New Ross Co-operative Company operates a Eureka 100-drop board and has 82 subscribers. The membership fee is $5, and 25c. per month.

MIDDLEBURY, IND.—The Elkhart County Telephone Company has a 100-drop board which gives good service to 175 subscribers. There are 50 miles of toll line. The rates $1 per month.

RIDGEVILLE, IND.—The Ridgeville Telephone Company operates a Stromberg-Carlson 100-drop board and has 140 subscribers. Several farm lines will probably be built this season.

SHERIDAN, IND.—The Central Indiana Telephone Company operates a 300-drop board; has 400 subscribers and 40 miles of toll line. Several improvements and additions are projected this summer.

MARIETTA, IND.—The Marietta & Bengal Telephone Company operates a 100-drop board, 84 of which are in use, and 125 subscribers. There are 25 miles of toll line and many improvements are projected.

WINAMAC, IND.—The Winona Telephone Company has just put in 2500 feet of cable and intends building more toll and farmers' lines. It has a 300-drop board, 250 subscribers and 75 miles of toll line.

NEWTOWN, IND.—The Newtown Telephone Company uses 50 drops of a 100-drop board, has 118 subscribers and 20 miles of toll line. It is owned by the farmers and merchants of the community who use 45 telephones and rent the rest.

STONE BLUFF, IND.—The Shawnee Telephone Company operates a 100-drop board with 240 subscribers and 40 miles of toll line. This is a farmers' exchange with an average of four subscribers on a line. Kellogg telephones are used.

RICHMOND, IND.—The Richmond Home Telephone Company has exhausted its switchboard and cable capacity and will increase the plant at once. It now operates a 1600-drop board and has 1800 subscribers, with 75 miles of toll line.

LOGANSPORT, IND.—The Wabash Traction Company has just completed a telephone system along its line between this city and Peru. The telephones are placed in iron boxes, at every switch, and each conductor has a key, which will open the boxes.

CARMEL, IND.—The Carmel Mutual Telephone Company has 260 subscribers, its switchboard capacity being 200 drops. It has 135 miles of metallic circuit toll lines. Its rates are $12 per year. Several of its party lines have six to twelve subscribers on a line. Mr. A. Newlin is secretary.

WINCHESTER, IND.—The returns for taxation show that telephone development has been rapid in Randolph County during the past year. At present the Eastern Indiana Telephone Company, with principal office here, has 96 miles of poles with 289 miles of wire in actual use; the Ridgeville Telephone Company has 16 miles of line in this and Jay County; the Farmland Telephone Company 57 miles of poles and 237 miles of wire; the Parker Telephone Company 42 miles of poles and 225 miles of wire and the Central Union Telephone Company, 309 miles of wire, while other companies have 35 miles of wire or more, making a total mileage in the county of at least 1,000 miles of wire.

SOUTH McALESTER, I. T.—The South McAlester-Eufaula Telephone Company is about putting in a full central energy system at Eufaula to cost $3,000. There is a 400-drop board here with 450 subscribers and 250 miles of toll line.

CADDO, I. T.—The Choctaw Telephone Company operates exchanges at Coalgate, Lehigh, Atoka and Caddo, with boards, two of 200 drops, one of 50, and one of 300. There are 700 subscribers at all places. It has 195 miles of toll line and more are projected.

SANBORN, IA.—The Sanborn Telephone Company operates a 200-drop board with 125 subscribers.

MANLY, IA.—The Manly Telephone Company has a 100-drop express type switchboard and 300 subscribers.

WATERLOO, IA.—The Cedar Valley Telephone Company has 3,000 subscribers and 1,000 miles of toll line.

JOICE, IA.—The Citizens' Mutual Telephone Company, with a capital stock of $10,000, has recently been organized by G. G. Hanner and others.

CLEAR LAKE, IA.—The Clear Lake Independent Telephone Company uses a Kellogg switchboard of 200 drops capacity and has 130 subscribers.

STUART, IA.—The Lincoln Mutual Telephone Company proposes putting in an exchange at Greenfield, Ia. It has 150 subscribers and 75 miles of toll line.

WOODWARD, IA.—The Wells Telephone Company gives service to 150 subscribers from a 200-drop board. There are 100 miles of toll line and more are planned.

CRESCO, IA.—The North Orleans Telephone Company is of recent formation, among the directors being W. F. Morton. The company has a capital stock of $800.

WILTON JUNCTION, IA.—The Wilton Telephone Company has recently built 13 miles of toll line, making in all 100. There are 140 subscribers and a 200-drop board.

GALVA, IA.—The Galva Telephone Exchange Company has a switchboard of 100 drop capacity, 80 being in use. There are 160 subscribers at $1.25 per month for telephones.

STATE CENTER, IA.—The State Center Telephone Company is operated in connection with the Boone & Marshall toll line. It has a 200-drop board and 150 town subscribers and 200 farmers.

BLANCHARD, IA.—The Blanchard Com. & College Springs Mutual Telephone Company has 112 subscribers and 18 miles of toll line at 10c. a message. The town service is to be enlarged.

MOUNT VERNON, IA.—The Mount Vernon Telephone Company is connected with the Cedar Rapids and Marion toll lines. It has a 240-drop board and the same number of subscribers. A new switchboard is to be put in.

CHARITON, IA.—The Chariton Telephone Company has 275 subscribers. Its board capacity is 400 drops, and its system includes 30 miles of toll line. Seventy-five subscribers are of recent addition. Its subscription rates are $1, $1.50 and $2.00. W. D. Boydston is secretary of the company.

JEFFERSON, IA.—The Green County Telephone Company has a total of 1,400 subscribers in towns and rural districts. Its switchboard capacity is 925 drops, the apparatus used being of the American Electric Telephone Company and Swedish American Telephone Company make. The toll line is 65 miles in length, the country service being free. Mr. P. C. Cockerill is secretary and manager.

SABETHA, KAN.—The Sabetha Telephone Company has a 300-drop board and 400 subscribers at $1.25 per month.

GARDEN CITY, KAN.—The Garden City Telephone Exchange has a 100-drop switchboard capacity and 90 subscribers.

LINN, KAN.—The Linn Telephone Company is now re-organizing for the purpose of taking in farmers' lines and making improvements.

COUNCIL GROVE, KAN.—The Council Grove Telephone Company operates a 500-drop board, has 300 subscribers and 200 miles of toll line. The company will soon double its capacity.

ELLSWORTH, KAN.—The Ellsworth Electric Light Company operates the telephone system here, and has a 200-drop board with 190 subscribers and 75 miles of toll line.

LYONS, KAN.—Mr. A. Long is the owner of the Lyons Telephone Exchange which supplies service from a 300-drop board to 220 subscribers. There are 98 miles of toll line and 14 of farmers' lines.

SMITH CENTRE, KAN.—The Exchange Telephone Company operates one exchange at this place and one at Lebanon. It has 210 subscribers and 102 miles of toll line. Some rural lines will be built.

INDEPENDENCE, KAN.—The telephone line here is operated by Messrs. Hickman & Pontius, who contemplate several additions this year. They have a 500-drop board, 425 subscribers and 50 miles of toll line.

STOCKTON, KAN.—The Stockton Telephone Exchange has a switchboard capacity of 150 drops, of which 132 are installed. The apparatus used is of the Stromberg-Carlson Company. Mr. H. W. Loomis is the manager.

OTTAWA, KAN.—The Ottawa Telephone Company has a 1100-drop board, 1,060 subscribers and 100 miles of toll line. The company has built up a most successful business in spite of active opposition and is firmly established now.

SENECA, KAN.—The Seneca Telephone Company reports a great demand for lines and many are to be extended. It operates a 250-drop board, 175 being installed for city subscribers. These, including farmers, number 375. There are 290 miles of toll and farmers' lines.

AUGUSTA, KAN.—The owner of the exchange here is Mr. T. Sexton. He uses 106 drops of a 200-drop board and has 90 subscribers. He is also interested in the Butler County Telephone & Electric Company, which has about 175 miles of toll line and in other Kansas exchanges.

MARION, KAN.—The Southwest Telephone & Electric Company operates exchanges in Marion, Peabody, Florence and Burns of 200, 200, 100 and 50 drops respectively. It has 450 subscribers and 120 miles of toll line. The plants are comparatively new, and rates have been raised, but without causing any loss of business.

CHETOPA, KAN.—The Chetopa Telephone Company has recently installed a new Kellogg board of 300-drop capacity. It now has 125 subscribers, and

operates 55 miles of toll line. Its rates are $12 per year for residence instruments and $24 for business. It is expected that an addition of 100 more telephones will soon be made. Among the recent improvements to the service is the installation of 3,000 feet of dry paper cable, having 50 pair of wires.

LOUISVILLE, KY.—The Ghent Telephone Exchange Company, of Carroll County, with a capital stock of $5,000, is of recent organization.

HOWARDSTOWN, KY.—The New Haven Telephone Company operates a nine-mile line and connects with the exchange of the Cumberland Telephone & Telegraph Company at New Haven, Ky.

COVINGTON, KY.—The North Kentucky Telephone & Telegraph Company has been organized with $10,000 capital stock by S. P. Kineon, F. K. Ludlow and M. M. Durrett, of Covington.

LONDON, KY.—The London Telephone Company is rebuilding, and in a few months will have a first class system with a number of new subscribers. It operates a 200 drop board, has 123 subscribers, and 100 miles of toll line, which is to be extended.

PADUCAH, KY.—The People's Independent Telephone Company has a 1,200 drop switchboard, with 1,000 subscribers, and 500 miles of toll line. This company has just commenced operations, and judging from its list of subscribers, is carrying everything before it.

ALEXANDRIA, LA.—A company has been organized here to build a telephone line to Monroe. Its capital stock is $50,000.

ALEXANDRIA, LA.—The Cumberland Telephone and Telegraph Company has made great improvement and has a 600 drop board with 438 subscribers, and 30 miles of toll line. Rates are $1.50 to $2, and $2.50 to $3.50.

VAN BUREN, ME.—The St. John Valley Telephone Company has 25 subscribers at $25 per year. It is expected to connect this system with the New England Telephone Company at Caribou, a distance of 22 miles.

LISBON FALLS, ME., has been the scene of a vigorous telephone fight, the New England Telephone Company seeking to extend its service in several streets where it is not now permitted to enter. The grant was opposed before the selectmen by the independent Northeastern Telephone Company. As a result of the hearing, the petitioners have been given leave to withdraw. Many of the property holders objected to the new pole lines.

SANDY SPRING, MD.—The Enterprise Telephone Company operates three exchanges and has metallic lines, all radiating from central. There is a 50 drop board and 170 subscribers, and short lines are to be built to take on more.

FALL RIVER, MASS.—The Fall River Automatic Telephone Company's switchboard has a capacity of 1,050 subscribers and 969 subscribers. Fourteen miles of toll line are now being built.

MORELIA, MEXICO.—A new telephone exchange is being established here. La Compania Noruega Mexicana, of the City of Mexico, can give information in regard to the enterprise.

CONCORD, MICH.—The Concord Telephone Company operates a 100-drop board and has 160 subscribers.

WOODLAND, MICH.—The Woodland Telephone Exchange operates a 100 drop board and has 150 subscribers at $12 per year.

FREMONT, MICH.—The Citizens' Telephone Company belongs to the Citizens' Company of Grand Rapids, Mich. It has a 140-drop board and 114 subscribers.

REED CITY, MICH.—The Reed City Telephone Exchange has 10 miles of toll line, but farmers' lines are very much needed in the district. Its board capacity is 200 drops and it has 190 subscribers.

ONAWAY, MICH.—The Onaway Telephone Company supplies service to Onaway and Rogers City, having switchboard capacity of 135 and 100 drops, and 160 and 100 subscribers in the two places respectively. There are 130 miles of toll line and 50 more are projected; seventy new subscribers are on the waiting list. Rates are $12 and $20 and 1c. per mile, unlimited.

ADRIAN, MINN.—The Midland Telephone Company operates an eight-drop board and has nine toll stations besides farmers' lines. Rates are 25c. per message.

ELBOW LAKE, MINN.—The Grant County Telephone Company has five exchanges and 350 subscribers. There are 125 miles of toll line, and farmers' lines are to be improved.

NEW SWEDEN, MINN.—The Nicollet County Telephone and Telegraph Company has two boards of 100 drops each, and 140 subscribers. There are 50 miles of farm and party lines. The company has now more applications for rural service than it can fill this season.

DODGE CENTER, MINN.—The Dodge Center Telephone Exchange contemplates building farmer lines West and North. It is now operating a Stromberg-Carlson 100-drop board and serves 60 subscribers. It is operating 15 miles of toll line jointly with the Hayfield Exchange. Its rates are $1 per month for residence instruments and $1.50 for business.

OXFORD, MISS.—The Oxford Telephone Company has sold out to J. W. Clark and F. L. Toale, of Hamilton, Ohio, and the new owners have taken charge.

OXFORD, MISS.—The Tabalubby Telephone Company has a franchise to construct a telephone line connecting Oxford, College Hill and other Mississippi towns. The stockholders are principally farmers.

HALE, MO.—The Missouri Midland Telephone Company has 60 miles of toll line and six subscribers.

DADEVILLE, MO.—The Farmer Telephone Company has a 50-drop board, 30 of which are installed, and over 300 subscribers at $1 per month.

GRANT CITY, MO.—The Grant City Telephone Company has a switchboard capacity of 200 drops and uses apparatus of the Williams-Abbott Electric Company. The charge is $1 per month for each instrument.

BROOKLYN, MO.—The Harrison County Mutual Telephone Company operates five boards varying in capacity from 25 to 50 drops. The company operates between 250 and 300 miles of party lines; it has no strictly commercial lines at present. Its charges are 15 cents per message and $12 a year rent for telephones. A large increase in capital stock will be made. Mr. W. E. Blakeman is secretary.

NORWOOD, N. Y.—The Norwood Telephone Company is about to construct 50 miles of toll line.

GENEVA, N. Y.—The Geneva Telephone Company has a Century board of 1,500 drops with 591 subscribers.

GOWANDA, N. Y.—The Gowanda Telephone Company operates a 280-drop board; has 350 subscribers and 150 miles of toll line.

FRANKFORT, N. Y.—The Schuyler Telephone Company has a 200-drop board and 163 subscribers. The rates are $12 per annum.

ITHACA, N. Y.—The Ithaca Telephone Company has a 600-drop board and 750 subscribers, and 100 miles of toll line. A large increase is contemplated.

CLINTON, N. Y.—The Clinton Home Telephone Company has a 100-drop board and 200 subscribers with 10 miles of toll line. It has connection with Utica, and is busy filling orders for farm lines.

LYNDONVILLE, N. Y.—The Lake Side Telephone Company, of Lyndonville, has been formed with a capital of $100,000. Directors: W. A. Tuttle and Grant Spaulding, Lyndonville; S. A. Coe, Yates.

GRANVILLE, N. Y.—The Granville Telephone Company operates one board of 200 drops; two of 100 each and three of 10 each, of Eureka and Chicago make. It has 700 subscribers and 100 miles of toll line. New lines are projected.

BROCKPORT, N. Y.—The Brockport Telephone Company has recently added 100 subscribers to its service, the total number now being 350. Its switchboard capacity is 200 drops. The apparatus used includes Kellogg and Williams telephones and a Sterling board. Its rates are $9 and $12 for residence service and $15 for business.

FAYETTEVILLE, N. C.—The Fayetteville Electric Supply Company is constructing a number of rural telephone lines in its section of the State.

WHITEVILLE, N. C.—C. D. Weeks has been appointed receiver for the Columbus Telephone Company, of Whiteville. The property will be sold to satisfy creditors.

CHARLOTTE, N. C.—The Bell Telephone Company has started work at Charlotte, placing wires underground, building a new exchange and overhauling the entire system at a total cost of $60,000.

ASHEVILLE, N. C.—The Asheville Telephone & Telegraph Company, with an authorized capital of $300,000, has been chartered by C. R. Craig and others. The company will have both preferred and common stock. A statement has been issued showing conclusively that the Asheville Telephone Company has lost heavily for several years. This is a report in the fight against a proposed merger with the Southern Bell Company and is said to mark perhaps the beginning of the end of the opposition to the merger.

WOODSFIELD, OHIO.—The Woodsfield Telephone Company has increased its capital stock from $10,000 to $15,000.

DAYTON, OHIO.—The Combination Telephone Company has been incorporated here with a capital stock of $100,000. Among the directors is W. C. Marshall.

JACOBSBURG, OHIO.—The People's Telephone Company has increased its capital stock from $1,000 to $2,000. M. R. Hart is president and Oscar Glidden, secretary.

NORWALK, OHIO.—The Local Telephone Company has received its new switchboard from the Kellogg Switchboard & Supply Company, of Chicago. The board will replace the one now in service.

MT. GILEAD, OHIO.—The Morrow County Telephone Company has closed a contract with the Stromberg-Carlson Telephone Company for a new switchboard and a large number of new telephones. The company was organized five years ago with $30,000 capital stock and it is without bonded debt. A. A. Whitney is president and Charles Dombaugh, general manager.

OTTAWA, ONT.—The Grand Trunk Railway Company is using the telephone in connection with the telegraph in the handling of its traffic. The combination system extends from Montreal to Coteau, Cornwall and Brockville. The system, it is stated, is giving satisfactory results, and it is the intention to extend it along the entire railway system.

PORTLAND, ORE.—It is stated that 1,000 telephones will be ordered out by the members of the numerous trade unions in order to aid the striking line men of the Pacific States Telephone & Telegraph Company. Thousands of dodgers have been scattered through the city asking the public to refuse to patronize the company on account of its hostility to union labor. At the next meeting of the City Council a petition will be submitted, asking for a franchise for an independent system.

FACTORYVILLE, PA.—The Factoryville Telephone Company, with a capital stock of $5,000, is of recent incorporation.

GEORGETOWN, S. C.—The Georgetown and Sampit Telephone Company has been organized, with a capital of $500.

BIG SPRINGS, TEX.—The Western Telephone Company has been organized here with a capital stock of $15,000. The incorporators are C. L. Alderman, Robert H. Kemp, Philip Pettit, E. B. Kemp and J. R. Compton, all of Big Springs.

PETERSBURG, VA.—The Petersburg Telephone Company is preparing to build a line to Manchester.

MECKLINSBURG, VA.—The Mecklinsburg Telephone Company has been incorporated with a capital stock of $5,000, by W. H. Elam and others.

GREENBUSH, WIS.—Mr. J. E. Dender and others have formed the Pulls Crossing Farmers' Telephone Company, the capital stock being $500.

ELECTRIC LIGHT AND POWER.

CLAYTON, ALA.—J. Williams, Mayor, writes to the effect that the contract for constructing water works and an electric light plant has been awarded to T. D. Grubbs & Co., of Clayton, for $24,898.

SEARCY, ARK.—The City Council has granted a franchise to P. F. Miller, of Chicago, Ill., to install and operate an electric light plant.

CORONA, CAL.—F. C. Cooper's franchise for an electric light plant and M. W. Findley's franchise for a gas plant form the basis of a consolidated gas and electric company here, to be known as the Corona Gas and Electric Company, which has been organized with a capital stock of $50,000, fully subscribed. The directors are M. W. Findley, president; F. C. Cooper, vice-president; E. A. MacGillivray, George Brown and M. B. Huff.

BOULDER, COLO.—The Boulder-Denver Water Power Company is encountering opposition in its effort to secure a franchise for the construction of a dam and the installation of a $1,000,000 electrical plant near this city. Many people object to the construction of the dam on account of the alleged danger of a flood. The plant, it appears, now, will probably not be installed, unless the company is granted the temporary use of city water for generating purposes.

LAKELAND, FLA.—The question of constructing water works and an electric light plant is under consideration here. For further information address D. H. Sloan, Secretary Bond Trustees. Bids for $35,000 water works, electric light and improvement bonds will be received on Sept. 12.

HARTWELL, GA.—The citizens have voted to issue bonds for electric lights.

CARROLL, IA.—The citizens have voted to grant a twenty-year franchise to the Carroll Electric Light & Power Company.

EMMETT, IDA.—The City Council has granted to W. H. Davis, of this city, a franchise to operate an electric lighting plant.

EMMET, IDA.—W. H. Davis, of Emmet, writes that he has a water power and will construct an electric light plant to cost $20,000. Bids for supplies will be received in about 60 days.

BERWYN, ILL.—Plans and specifications for a municipal electric light plant have just been completed by Charles Whitney Carman & Co., the consulting engineers of Chicago. Bids for the construction of the same are desired.

MARSAILLES, ILL.—The Marsailles Land & Water Power Company is increasing the capacity of its hydraulic plant from 2,000 to 5,000-hp, and is also constructing an electric light plant of a capacity of 1,000-hp, which will be equipped with steam auxiliaries. The new installation consists of 62-inch wheels of Leffel make, working under a 10-foot head. Hayes Bros., of Zanesville, Wis., are the contractors, and A. F. Crane, of Chicago, is the consulting engineer.

NEW ALBANY, IND.—It is reported that the United Gas & Electric Company will erect a large addition to its power house.

WINONA LAKE, IND.—The Winona Electric Light & Water Company has been formed, with a capital of $100,000, by Thos. Kane, Sol. C. Dickey and others, to supply Winona Park and Warsaw with light and water.

TERRE HAUTE, IND.—The Terre Haute Electric Company has purchased a lot on the river front and will soon erect a new power plant. The new location will enable the company to build a much larger plant than the present one.

SOUTH BEND, IND.—F. M. Gray, of Niles, Mich., is reported to have purchased a controlling interest in the water power of "west race." The 2,000 horse power will be converted into electrical energy, the power to be transmitted to South Bend.

INDIANAPOLIS, IND.—The Winona Electric Light and Water Company has filed articles of incorporation. The capital stock is $100,000. The directors for the first year are: S. C. Dickey, E. A. K. Haekett, H. P. Townley, Thos. Kane, E. F. Yarnells, C. H. Worden and H. W. Johnson.

CRAWFORDSVILLE, IND.—An ordinance has been introduced providing for the appointment of a board of electric light trustees to take charge of and manage the municipal lighting plant. The present scheme of municipal management is not satisfactory, and the leakage is entirely too great. If controlled by a board of trustees it will be more independent and free from the political element which enters into present management.

RICHMOND, IND.—The first annual report of the municipal light plant has been made to the City Council. The receipts for light and power aggregate $18,362.21, in addition to which there was received in loans from the city of $17,900, and from sales of supplies $410.32, making a total of receipts $36,672.53, of which $18,362.21 was earned. The total cost of meters, wire and equipment of every kind was $18,204.02. The actual maintenance, which includes coal, pay-roll, repairs, etc., was $17,170.70. The total expenditure shows a deficit over actual receipts of about $17,300. The friends of the municipal plant claim this was to be expected, because of the extension of lines, etc. Those not friendly to the system say the plant is being operated at a loss, and the debts are accumulating. The Richmond Light, Heat & Power Company has let the contract for an addition to its power plant that will practicaly double its capacity. It is freely predicted by some that the private company will in time purchase the municipal plant.

MONROE, LA.—Bids are wanted Aug. 17 for direct-connected engine and alternator, arc light transformers, etc. Address C. A. Downey, Mayor, pro. tem.

NEEDHAM, MASS.—The Greendale Chemical & Electric Lighting Company, of Needham, has secured the contract for street lighting for five years, commencing Oct. 1, at $10 per light per year for the first 500 lights, all above 500 to be $9 per light.

MONTEMORELOS, MEXICO.—R. A. Votaw, of San Antonio, Tex,, contemplates the establishment of an electric light and power plant here. About $175,000 will be invested in the enterprise.

CITY OF MEXICO, MEXICO.—Andres Lefevre has made application to the Federal Government for a concession for the establishment of an electric power plant on the Tulancingo River, in the State of Vera Cruz.

ACAMBARO, MEXICO.—A large water power plant is being constructed on the Lerma River at this place. The promoter of the enterprise is George Braniff, of the City of Mexico. The plant is to be used for generating electrical energy for lights and power to be used in this section, and for irrigating a large tract of land situated along the Lerma River.

EL ORO, MEXICO.—Las Dos Estrellas Mining Company, of which Jose J. Reynoso is general manager, has obtained a concession for the utilization of the waters of the Cienega River in the District of Tlalpujahua for industrial purposes. A large electric generating plant will be established there. The power will be transmitted to the company's mines here.

MORELIA, MEXICO.—The Iguaran Copper Mining Company, which operates large copper mines in this State, is constructing a large power plant near its properties. This plant is situated at Mata de Platano, a distance of six and one-half miles from the mines. The power is obtained from mountain springs. The head of water is 930 ft., and the volume is about 80 litres per second. It is expected that 200 hp. will be obtained for delivery to the mines.

RIVER ROUGE, MICH.—The proposition to issue $28,000 electric light bonds has carried.

TAWAS CITY, MICH.—The question of constructing water works and an electric light plant is reported to be under consideration. The plant will cost about $15,000.

FARIBAULT, MINN.—It is stated that the Polar Star Electric Light Company will construct a power house to cost $50,000.

BROOKLYN, N. Y.—An iron smokestack, 125 feet in height, which had just been raised into place at the new electric power plant of the Museum of the Brooklyn Institute of Arts and Sciences, at Eastern Parkway and Washington Avenue, fell recently and narrowly missed crushing half a dozen workmen to death. The damage to stack and power house is estimated at $1,000.

BROOKLYN, N. Y.—The statement is made that large water pipes in the Brooklyn Navy Yard have been attacked by electrolysis and that the government may sue the Brooklyn Rapid Transit as a result of the investigation now being made.

CHARLOTTE, N. C.—The S. B. Alexander, Jr., Company, of Charlotte, has the contract for installing an electric light plant for the town of Winnsboro, S. C. The General Electric Company will furnish the electrical material.

TONOPAH, NEV.—The Owens River Water & Power Company, which was recently organized to supply Tonopah, Nev., with electric light and power, has been incorporated in San Francisco, with a capital stock of $3,000,000. Among the incorporators are W. H. McClintock, of Sonora; John Landers and Eugene S. Watson, of San Francisco. Leon M. Hall, who has offices in the Hayward Building, is the company's electrical engineer. The company has secured water rights on Owens River, Inyo County, Cal., which are capable of developing 10,000 hp. for transmission 90 miles to Tonopah. A local electric lighting plant in Tonopah is owned by the same capitalists. The initial installation will probably consist of three 1,500-kw three-phase 25-cycle generators, direct connected to impulse waterwheels. By adopting 25-cycle apparatus the company will save considerably in the number of transmission lines required, when the capacity of the plant is increased. This will be the first long-distance transmission line on the coast to adopt 25 cycles. The new electric power plant of the United Railroads in San Francisco is now generating current at 25 cycles, one unit consisting of a marine type vertical engine and two three-phase General Electric generators being in operation.

JAMESTOWN, N. D.—The Western Electric Company was organized in 1902 with $25,000 capital. Its president is Mrs. J. H. Canham. The company furnishes 20 city and 15 commercial arcs and 4,000 incandescent lights.

ATHENS, OHIO.—The citizens are reported to have voted to issue electric light bonds.

HUBBARD, OHIO.—This village will issue $10,000 bonds for an electric light plant. J. Edward Schreiber is Village Clerk.

OBERLIN, OHIO.—The Oberlin Gas & Electric Company has increased its capital from $30,000 to $75,000. The plant will be improved.

PAYNE, OHIO.—The Payne Electric Light & Power Company, of Payne, has been incorporated, capital $10,000. Incorporators: Wm. Roose, W. S. Phillips, H. H. Roose and others.

CELINA, OHIO.—Bids will be received and opened at 9 a. m., Aug. 6, at Celina, for boilers, engines and alternators. Ten thousand dollars has been appropriated for this improvement. The plant is controlled by the village of Celina. H. L. Canfield, of Delphos, Ohio, is the enigneer.

MARIETTA, OHIO.—A strong organization is being formed in Pittsburg for the erection of a large power plant for the supply of electrical power to a large number of manufacturing plants in the Ohio Valley. Gen. A. J. Warner, of Marietta, is at the head of the company. He has recently purchased large coal fields in West Virginia, and it is the plan to utilize the coal and slack for the generation of gas and converting it into electrical power through the use of gas engines.

TORONTO, ONT.—The Retail Merchants' Association, of Toronto, has indorsed the Stark electrical system, by which power, light and conversation will be conveyed over the same line. Telephones will be given at $6 each, plus 1 cent a call, the yearly cost not to exceed $45 for business telephones and $25 for house telephones. Light will be given at 8 cents per kw-hour, and power at 4 cents per kw.-hour.

SPARTA, ORE.—Work has been commenced here on the construction of a large power plant, which will be installed at a total cost of $2,000,000. The purpose is to furnish power for Baker City, Union, La Grande, Sumpter and for numerous mines. About 170 miles of wire will be required. A flume three miles long is now in course of construction, and will have a capacity of 10,000 hp. The plant, it is stated, will be in operation by January 1, 1904.

MIDDLETOWN, PA.—There is a municipal plant at this place under the superintendence of Mr. F. P. Stauffer. It operates 67 arc lamps of 2,000-cp and 3,000 incandescents.

SHAWINIGAN FALLS, QUE.—The Shawinigan Water & Power Company has closed a contract with the Sorel Electric Company to deliver electricity in the city of Sorel, Que., for the purpose of light, heat and power. The Sorel Company has been formed by prominent business men of that city, and will put in a complete system of lighting for supplying both the city of Sorel and private consumers. The delivery of power, under the contract, calls for the building by the Shawinigan Company of a 20-mile transmission from Joliette, on its main transmission line, through the village of Lanoraie to Sorel. From Lanoraie, the line will cross the St. Lawrence River by means of a submarine cable.

BROWNSVILLE, TEX.—Local citizens contemplate establishing an electric light and power plant here. Hon. James B. Wells can probably give information in regard to the proposed enterprise.

VICTORIA, TEX.—The Victoria Manufacturing Company has been organized here with a capital stock of $200,000 to supply electric light and power, gas, heat and water. The incorporators are John J. Welder, H. E. Rathbone, F. E. Sibley, Theodore Buhler and F. C. Proctor, all of Victoria.

CEDAR CITY, UTAH.—A franchise for the operation of an electric lighting plant has been granted to Charles M. Lang, of this city, by the City Council.

SALT LAKE CITY, UTAH.—It is stated that the Utah Light & Power Company will construct an addition to the Jordan power plant, to cost about $200,000.

NEWPORT NEWS, VA.—The Consumers' Light, Heat & Ice Company is stated to have issued $250,000 bonds to enlarge its plant here.

MARINETTE, WIS.—It is reported that the Crawford Lumber Company, of Marinette, will install a 300-light electric lighting plant at Cedar River.

JANESVILLE, WIS.—P. H. Korst, general manager of the Janesville Electric Company, writes that the proposed improvements in the company's plant will cost about $30,000, and will be let separately as follows: four turbines, shafting, boilers and building a new power house. The engineers are D. C. & W. B. Jackson, of Madison, Wis.

THE ELECTRIC RAILWAY.

BIRMINGHAM, ALA.—It is reported that the Birmingham Railway, Light & Power Company is figuring on the construction of several new lines.

MADERA, CAL.—Articles of incorporation of the Madera Railway Company have been filed. The company has a capital stock of $50,000. The directors are J. C. Campbell, R. W. Campbell, A. C. Towne, J. H. Tate and F. C. Drew.

APALACHICOLA, FLA.—The City Council has granted a franchise to citizens of Apalachicola for a street railway.

MOLINE, ILL.—At a recent meeting of the Dixon, Rock Falls & Southwestern Electric Railway Company G. T. Shaw, of Dixon, was elected president; A. C. Stanley, vice-president; R. L. Leitsch, secretary; O. E. Maxson, treasurer and H. L. Sheldon, attorney, all of Rock Falls.

MONMOUTH, ILL.—The Western Illinois Traction Company has commenced work on the Galesburg line. The officers and promoters of this company are W. B. Young, president; G. W. Gale and W. W. McCullough, vice-presidents; W. H. Woods, treasurer. The company was incorporated with a capital stock of $500,000. The total cost of the road will be about $400,000.

WABASH, IND.—The contract for the building of the interurban railway between this city and Marion has been awarded to J. G. White & Co., of New York. The length of the line is 20 miles. Contracts for the steel and ties have been placed, and other equipment is now being contracted for.

INDIANAPOLIS, IND.—A novelty in interurban railway construction in Indiana will be introduced by the Indianapolis & Martinsville Railway on its extension from Martinsville to Bloomington by the construction of a tunnel through the hills in the northern part of Monroe County. The tunnel will be about 1,500 feet in length. It will be constructed through solid sandstone, and will involve an expenditure of between $75,000 and $100,000.

LAFAYETTE, IND.—The promoters of the electric railway which will connect Lafayette with Tipton, Frankfort and Attica, have elected officers as follows: Col. J. G. Clark, of Frankfort, president; Samuel Clark, of Attica, vice-president; Hez M. Cohee, of Frankfort, secretary; M. Epstein, of Frankfort, treasurer; W. R. Dunham, of Tipton, auditor; J. G. Clark, J. H. Fear, J. C. Shanklin, of Frankfort; Samuel Clark, T. M. Green, of Attica; W. R. Dunham, George Shortle, of Tipton, directors.

DAVENPORT, IA.—The Davenport & Clinton Traction Company will be the name of the interurban railway which has been promoted under the name of John U. May. The company is capitalized at $500,000, with the privilege to increase the capital stock to $3,000,000. Ulysses D. Eddy, president of Flint, Eddy & Company, of New York, will be president; John U. May, vice-president and treasurer and Herbert T. Beatty, secretary.

LOUISVILLE, KY.—The directors of the Louisville & Cincinnati Interurban Electric Railway Company have elected the following officers: President, George W. Lewman, of Louisville; vice-president, Louis Hartmann, of New Albany; secretary and treasurer, John F. McCulloch, of Charlestown township, Ind.

ELKTON, MD.—The Cecil & Kent Light, Power & Railway Company has taken steps to construct the proposed electric railway between Elkton and Chesapeake City. A committee was appointed to make a contract with the Tennis Company, of Philadelphia, to build the road.

HAGERSTOWN, MD.—It has been officially announced that the Hagerstown Electric Railway Company will build an electric railway across South Mountain from Boonsboro, to Myersville, thus connecting Frederick and Hagerstown by trolley. The distance is 5 miles. The cost will be $50,000.

CUMBERLAND, MD.—The Frostburg & State Line Electric Railway, Light & Power Company has been incorporated with $120,000 capital. The incorporators are William A. Wood, Joseph W. Reynolds, Pittsburg; Robert R. Henderson, William H. Cole, Cumberland; George G. Townsend, Frostburg. It is part of the system to connect Cumberland and Johnstown, and companies will be organized in Pennsylvania to fill several gaps. The consolidated company is incorporated under the laws of New Jersey, with $8,000,000 capital.

MARLBORO, MASS.—The Marlboro Street Railway, including a power house, together with cars and equipment, was sold at public auction July 25, to William A. Quigley, of Boston, for $102,775. Mr. Quigley represented the Boston & Worcester Street Railway Company.

ALLENDE, MEXICO.—A street car line is to be constructed between this place and Zarazoza, and it is the intention of the promoters to eventually extend the line to Ciudad Porfirio Diaz. Messrs. Mackin & Dillon, of Monterey, may be able to give information in regard to this enterprise.

BUTTE, MONT.—The Salmon River Electric Railway Company has filed articles of incorporation, the incorporators, all of whom are residents of Billings, are P. B. Moss, H. W. Howley, M. A. Arnold, I. B. O'Donnell and O. F. Goddard. The articles state that the company will construct an electric railway system from this city to a point on the Salmon River in Idaho, a distance of 187 miles. A survey for the line has been made. The estimated cost of the system is $2,000,000.

ALBANY, N. Y.—The Newburgh, Highland & Poughkeepsie Traction Company has been incorporated. The capital stock is $100,000. Among the incorporators are Joseph A. Duffy, Thomas G. Hinds and others of Jersey City, N. J.

BROOKLYN, N. Y.—It is unofficially stated that the Brooklyn Rapid Transit Company, to conform with the new law which compels the abolition of grade crossings of steam roads within the city limits, has decided to elevate the tracks of the Brighton Beach Railroad. This projected improvement will cost fully $1,000,000. The line runs over a private way, which the company owns in fee, but the trains pass through the most aristocratic suburban section of the borough.

MARION, OHIO.—J. G. Webb, president of the Marion Railway, Power & Lighting Company, states that the company will build a $350,000 power and lighting station in Marion.

MARION, OHIO.—The Marion & Findlay Railway Company has been incorporated, with $10,000 capital stock, by J. W. Scott, R. M. Shute, Charles E. Watson, W. K. Stanley and R. B. Oliver.

COLUMBUS, OHIO.—The Lancaster, Logan & Nelsonville Traction Company has applied to the State Commission for a lease for fifteen years, of 34 miles of the bed of the abandoned Hocking canal, for right of way for its line.

CLEVELAND, OHIO.—The Mansfield & Eastern Traction Company has filed a mortgage for $600,000 to the Central Trust Company, of Cleveland, covering a bond issue for the same amount. The road is being built between Mansfield, Mifflin and Ashland, and will furnish heat and light, as well as operating freight and passenger cars. William J. Pentz is president and J. W. Galbraith, secretary of the company. The offices are at Mansfield.

MARION, OHIO.—The formal consolidation of the Marion Street Railway Company and the Marion Electric Light & Power Company has been effected, under the name of the Marion Railway, Light & Power Company. The company has $500,000 capital stock, and is owned by the parties who control the Columbus, Delaware & Marion Railway. It will be operated on close terms with the interurban road. It is announced that the city system will be extended, and that the car equipment will be increased.

HAMILTON, ONT.—The Hamilton Cataract Power, Light & Traction Company has secured an act of incorporation, confirming the purchase of the Hamilton Electric Light & Cataract Power Company, which owns the Hamilton Street Railway, the Hamilton Radial Electric Railway and the Hamilton & Dundas Railway.

MOUNT UNION, PA.—It is stated that an electric railway will be built from Mt. Union to Chambersburg.

LANCASTER, PA.—The Lancaster County Railway & Light Company has leased the line of the Lancaster & Rocky Springs Railway Company.

GETTYSBURG, PA.—Engineers have begun the preliminary surveys for the proposed electric railway between Mount Holly Springs and Gettysburg via Biglerville and Bendersville.

HARRISBURG, PA.—A charter has been granted to the Gettysburg & Mt. Holly Street Railway Company, capital $300,000. The officers are Charles H. Mullin, president; Lyman D. Gilbert, Patrick Russ, Benjamin C. Warnick and R. W. Woods, directors.

GETTYSBURG, PA.—It is said to be the intention of the new owners of the Gettysburg Transit Company, operating the battlefield trolley line, to extend the line to Littlestown and Westminster, Md. C. Taylor Leland, of Philadelphia, and Thomas V. Cooper, of the Westinghouse Company, recently secured almost the entire stock issue of the company.

HARRISBURG, PA.—At a meeting of the incorporators of the new Central Pennsylvania Traction Company, Frank B. Musser was chosen president. B. F. Myers was chosen vice-president; W. J. Calder, secretary and treasurer, and the fifteen directors of the Harrisburg Traction Company were continued as directors of the new company. Arrangements were also made over the lines of the Harrisburg Traction Company.

MILFORD, UTAH.—An electric railway will be constructed between this city and Dixie, a distance of 130 miles. George E. Lane, of Milford, is at the head of the enterprise. He states that the necessary funds have been arranged for, and that the total cost of the system will be in the neighborhood of $3,500,000.

MOUNT VERNON, WASH.—George M. Stewart and others propose an electric light plant and electric railway, the latter to extend 100 miles.

SPOKANE, WASH.—The Spokane Traction Company has issued bonds to the extent of $1,000,000. This money is to be spent in Spokane for extensions and improvements of its new street railway system.

CHARLESTON, W. VA.—The Ohio Valley Street Railway Company, of Chester, has been incorporated by J. A. Gardner, T. C. Pitcairn, John W. Bailey, George H. Walmer and others.

GRAFTON, W. VA.—The Taylor County Electric Street Railway & Supply Company has organized by electing directors as follows: A. J. Wilkinson, George L. Jolliffee, James W. Holt, L. E. Ward, Dr. A. S. Warden, B. F. Bailey and T. E. Joyce.

HUNTINGTON, W. VA.—A street railway syndicate, headed by James Truby, L. W. Leete and Elliot Northcot, backed by eastern capital, has been organized to build an electric railway from Central City, through Huntington. An application has also been filed for a franchise.

EAU CLAIRE, WIS.—The Chippewa Valley Electric Railway Company is planning extensive improvements to its system.

NEW INDUSTRIAL COMPANIES.

THE STANDARD CONTRACTING COMPANY, of Wilmington, Del., has been incorporated to maintain and operate telephone and telegraph lines and electric railways; capital, $100,000.

THE LINCOLN STREET CAR & HEATING COMPANY, of Jersey City, has been incorporated with a capital of $110,000. Incorporators: Louis B. Dailey, Warren N. Akers and H. O. Coughlan.

THE ELECTRIC BRICK & FUEL COMPANY, of Aledo, Ill., has been incorporated with a capital stock of $100,000. The incorporators are Benjamin Townsley, Charles W. Smith and John Kerns. It is proposed to manufacture brick, coal, electric light, gas, tile, etc.

THE MEXICAN ELECTRICAL CONSTRUCTION AND SUPPLY COMPANY, of the City of Mexico, has been incorporated in Illinois. The company will do a general electrical construction business, erecting telephone, light, heat, power, railway and signal systems.

THE GRANITE CITY-VENICE ELECTRIC COMPANY has been incorporated at Granite City, Ill., with a capital stock of $500,000. The incorporators are Rufus C. Dawes, Henry C. Wood and Edward Clifford. It is the purpose of the company to engage in a general electrical business.

LEGAL.

FRIGHT FROM TELEPHONE POLES.—In the appeal case of Missouri & Kansas Telephone Company v. Vandevort, before the Supreme Court of Kansas, it was held that in an action to recover for injuries resulting from alleged negligence in placing two telephone poles on the side of the highway in such a way as to frighten horses, and where the location, condition, color and appearance of the poles, and all of the circumstances surrounding them, could have been easily described by witnesses, the opinions of experts as to whether the poles were calculated to frighten horses were not admissible.

NEGLIGENT ELECTRIC LIGHT LINEMAN.—In the case on appeal to the Supreme Court of Nebraska, of the New Omaha Thomson-Houston Electric Light Company vs. Johnson, the opinion of the court is summarized as follows: Evidence held not to support a finding that plaintiff's intestate came to his death from accidentally stepping upon scrap iron electrically charged from the wires of the electric light company. Evidence held to show that, if fatal contact was with defendant's guy wire, such contact was voluntary, and after warning on deceased's part. Defendant company held to be under a duty to exercise all reasonable precaution against passing a dangerous current of electricity through a guy wire attached to a pole on a vacant and uninclosed lot in a densely peopled part of a city. Where there is very slight evidence of intoxication, it is not error to refuse an instruction telling the jury that contributory negligence, caused by intoxication, would be a defense; the court having fully instructed as to what would constitute contributory negligence. The case was remanded to the lower court.

RIGHTS OF A TELEPHONE COMPANY.—A case was decided recently by the Kentucky Court of Appeals between the Cumberland Telephone & Telegraph Company and the Louisville Home Telephone Company. There were in fact two suits. The Court held: 1. Where a foreign corporation had spent nearly $500,000 in the construction of a telephone system in a city in the State under a franchise granted by the city, it had a right to sue in the courts of the State to protect its rights; and the fact that all of its incorporators but one were residents of the State, and that the evident object of forming the corporation elsewhere was to obtain the benefit of less rigorous laws, could not defeat that right; it appearing that the State was not complaining. It also held: 2. Where a telephone company had been granted a permit to erect its poles on the same side of a street with the poles of another company, having a prior, but not exclusive, franchise, and the old company, whenever the new one started to put in poles of a certain height, immediately changed its own poles, and made them of such a height as to prevent the new company from proceeding, an injunction was issuable.

TELEPHONE POLES ON STREETS.—In the suit of the Northwestern Telephone Exchange Company vs. the Twin City Telephone Company before the Supreme Court of Minnesota, on appeal, it was held that, in the absence of positive regulation by statute or ordinance controlling the construction of telephone lines in a municipality, the party first lawfully installing its lines acquires superior rights in the erection of poles and wires in streets which forbids a subsequent occupant for the same purposes to interfere therewith. The prior lawful occupancy of urban streets by a telephone company will not necessarily create a monopoly of all the aerial space which it appropriates, but may give such occupant such substantial rights in the conduct of its business as may be required in the growth and extension of the same to meet the immediate demands of the public service subject to the right of the courts to restrain another telephone company from unnecessary interference therewith. Under privileges granted by the city of Minneapolis, the plaintiff, in 1878, placed its poles and wires in its highways, and has from time to time maintained and extended the same to meet the necessary requirments of its business. In 1898, by authority of a charter from the city, the defendant crossed the lines of plaintiff upon poles at street intersections and placed its wires immediately thereunder, in such a manner as to interfere with the prior occupant in the necessary use of its franchise. It was held that such erection and maintenance of its poles and wires by defendant was an illegal impairment of the plaintiff's rights, which could be restrained by injunction.

INTERRUPTING TELEPHONE LINES.—In the suit before the Court of Civil Appeals of Texas, between the Southwestern Tel. & Tel. Company and Priest et al., when a rehearing was denied, the opinion stated that under Pen. Code, art. 784, it was an offense to wilfully interfere with the transmission of messages along a telegraph or telephone line, and it was held that, to constitute an offense under such article, there must be a breaking, cutting, etc., of some wire, post, machinery, or other necessary appliances, so as to interfere with the transmission of messages. The telephone company offered a reward for the conviction of any person guilty of cutting, pulling, tearing down, or misplacing its telephone wires, posts, or machinery, or unlawfully obstructing the transmission of messages in violation of article 784. It was also held that, in an action against the company to recover the reward because of the conviction of one for cutting a wire, the fact that the wire cut was a dead one, and did not come within the offer, and that plaintiff had personal notice that the reward did not apply to such wires, was properly pleaded as a special defense. A constable who arrests a person for misdemeanor in the discharge of his duties as an officer is not entitled to recover a reward offered for the conviction of any one committing such misdemeanor. In an action to recover a reward offered for the conviction of any one committing certain misdemeanors, two other persons beside plaintiff, who claimed the reward, were made parties, and defendant appealed from a judgment dividing the reward between all the claimants. A claimant, not having appealed from the judgment, could not file an assignment of error, and have the judgment below reversed, and judgment rendered in the appellate court in his favor for the entire amount.

TELEPHONE FRANCHISES.—The case of Mahan v. the Michigan Telephone Company before the Supreme Court of Michigan, resulted in the following: 1. The city ordinance authorizing a telephone company to construct lines and transact business in the city provided that, if the company should transfer its rights to any other telephone company, the company acquiring such rights should be subject to the terms of the ordinance, and that all the obligations imposed by the ordinance should apply to any assignee or successor of the grantee. This ordinance was accepted in writing, and was held to constitute a contract between the grantee in the ordinance and the city. 2. A company purchasing all the tangible property of the grantee in the ordinance, and its rights under the ordinance, will be considered as having purchased with notice of the conditions of the ordinance, and bound by all the obligations of the assignor. 3. An ordinance granting a telephone company the right to operate a telephone system in a city provided that, if the company should assign its franchise, the assignee should be bound by all the obligations of the assignor. Another telephone company, which operated an exchange in the same city, purchased the property and franchise rights of the grantee in the ordinance, and, for a considerable time after the purchase, gave the subscribers of the assignor company access to the subscribers of the assignee company. It was held that such action constituted a construction of the ordinance granted to the assignor company, and an acknowledgment of the assignee's obligations thereunder, which the assignee was not thereafter at liberty to repudiate. 4. Where a telephone company refuses a subscriber connections through its exchange, when he is properly entitled thereto, his right to such connections may be enforced by mandamus.

FRANCHISE FOR LIGHTING.—An interesting action has recently been decided in the Kentucky Court of Appeals between the People's Electric Light & Power Company and the Capital Gas & Electric Light Company, both of Frankfort. The following points summarize the decision: 1. Where the exclusive franchise to furnish light to a city has been granted to a gas and electric light company, and another company also claims such right, thereby casting a cloud on the title of the first company to the right claimed by it, injunction to restrain the second company from setting up such exclusive right is the proper remedy, though the first company is not in possession of the streets. 2. In an action by a gas and electric company, claiming that the exclusive franchise to light the streets had been granted to it, to restrain another company from setting up a claim to a similar exclusive right, a plea of champerty by defendant, on the ground that it had the exclusive right to furnish light at the time the plaintiff's franchise was granted, was demurrable. 3. A plea denying that the sale of the franchise to appellant was advertised, or that bids were publicly received therefor, or that the franchise was sold to appellant as the highest and best bidder, stated a good defense. 4. Where the charter of a gas company did not authorize it to furnish any other light than gas, and it had no facilities for so doing, a franchise granted by a city to such company, giving it the exclusive right to use the streets to furnish gas and "other illuminating light," was void as to "other illuminating light." 5. A city contracted to deed its gas plant and grant an exclusive franchise to furnish gas and other light to a company whose charter gave it no right to furnish any light but gas. The deed was made to an assignee of this company, and the assignee's charter provided that it should furnish gas and electric light. The deed imposed no obligation on the grantee to furnish any other light than gas. *Held*, that the deed did not give the grantee an exclusive right to furnish electric light. 6. Contracts made by the grantee with the city with reference to furnishing electric lights, which did not impose on the company any duty to furnish such light, did not give the company an exclusive right to furnish electric light. 7. Under Const. § 164, providing that, before granting any franchise for a term of years, a city shall receive bids therefor and award the same to the highest and best bidder, a city cannot enlarge a franchise already granted, except by award to the highest and best bidder.

PERSONAL.

HENRY J. HALLBERG.

MR. HENRY J. HALLBERG, who as already announced in these columns, has been appointed general superintendent of the electric lighting department of the Cincinnati Gas & Electric Company, was born at Falkenberg, Sweden, July 22, 1874, and received his early education in that country. He arrived in America in October, 1890, and entered immediately the large machine shops of the Ottumwa Iron Works at Ottumwa, Ia., as an apprentice in the machinist trade. His work in that line extended over a period of three or four years and was confined to the construction, installation and testing of steam engines and mining machinery. After completing this mechanical course, he entered into the electrical field as the Iowa representative of the Walker Electrical Mfg. Company, of Cleveland, Ohio, Kohler Bros., of Chicago, and the Smith-Hill Electric Elevator Company, Quincy, Ill. He superintended the erection of several street railway, lighting, power and elevator plants for these companies, and discontinued this work when the manufacturing companies were absorbed by some of the larger electrical interests; after which he became attached to the sales engineering staff of the Electric Appliance Company, of Chicago. In the fall of 1896 he accepted an appointment as designing electrical engineer with the Standard Thermometer and Electric Company at its works in Peabody, Mass., having entire charge of the electrical manufacturing department. He continued in this office until Sept., 1899, when he was offered a position as electrical engineer with the General Incandescent Arc Light Company, which he has held up to the present time. During his connection with the two latter concerns he has designed and perfected a large number of electrical appliances, and has had charge of several of the largest engineering contracts in this country and Canada in which these companies have been engaged. One of the most important equipments which he designed was the apparatus for the arc lighting plant installed on the banks of the Cornwall Canal in Canada. This installation is under Government control and the installation of that system involved many new and important engineering problems, as the arc lighting circuits are unusually long, comprising 120 lamps in series, and are operated at the extremely high potential of approximately 10,000 volts. This plant has now been in operation for more than two years and its success has been clearly demonstrated. One of his other important steps in the engineering profession was the design of the new street lighting system installed in Cincinnati. It is not generally known that this lighting system is the largest in the world with low amperage lamps. Aside from his technical and practical connection with the electrical engineering profession above referred to, Mr. Hallberg has contributed a number of articles to the electrical press, and has presented and discussed papers before the various electrical and mechanical societies in this country. He has taken out more than 15 American patents, and has at the present time about 10 more patents applied for, both in America and in five European countries. Mr. Hallberg and his wife will remove to Cincinnati at once, as his new duties begin there August 15, when a large extension of the new lighting system is to be effected.

VICE-PRESIDENT HART, of Hart & Co., is on an extended trip to Europe, where he will look after his company's business.

MR. S. W. MOON, well known through various prominent positions held in the telephone manufacturing industry for many years, has recently become secretary and general manager of the Illinois Electric Specialty Company.

MR. G. J. YUNDT, it is stated, will be appointed electrical engineer of the Southern Bell Telephone Company at Atlanta, Ga., to succeed E. H. Bangs, resigned, who has accepted a position with the Central Union Telephone Company.

MR. O. H. ENSIGN, of Los Angeles, Cal., has been elected president of the Electrical Engineering Club of Southern California, which has been organized with the ultimate purpose of affiliating with the American Institute of Electrical Engineers.

LIEUT. COMMANDER JOHN B. BLISH, U. S. N., formerly in technical charge of naval electrical work, is the author of a paper entitled "The Navigator's Prism," printed in the current issue of the *Proceedings* of the U. S. Naval Institute.

MR. EMILIO DYSTERUD, chief engineer and general manager of the Monterey Electric Light & Power Company, is now in New York. Down-town he may be found at the offices in the Washington Life Building of the Federal Electric Company.

MR. AND MRS. C. J. GLIDDEN, of Boston, started, on July 29, from Copenhagen in an automobile, intending to cross the Arctic circle. If they succeed they will be the first persons who have ever reached such a northerly point in an automobile.

MR. A. J. DE B. CORRIVEAU, of Montreal, who has been agitating the subject of an automobile exhibition and a run from New York to that city, has a favorable communication from Mr. John McDougall, of the customs department, as to measures of a liberal character to meet the occasion.

MR. I. S. HOFFMAN, for a number of years manager of the Mansfield, Ohio, Telephone Company, has resigned to accept the presidency and general management of the Mexican Electrical Construction & Supply Company, of Mexico City, a new organization recently incorporated in Illinois.

MR. ROBERT A. BYRNS has taken up the agency for Eastern territory of the Northern Engineering Works, with offices at 120 Liberty Street, and will push their dynamo machinery, motors, etc., vigorously. Mr. Byrns is a young electrical engineer who has a wide acquaintance and an excellent experience in the electrical field.

MR. F. L. DAME, for the past two years general manager of the Union Electric Company, Dubuque, Ia., has accepted the position of engineer of the Local Companies' Committee of the General Electric Company. It is expected that Mr. Dame will assume his new duties with headquarters at Schenectady, N. Y., about the middle of August.

MR. T. A. EDISON denies the stories as to his own serious injuries from Röntgen ray experiments, but admits that the Dally brothers, who have been associated with him in this work have sustained burns that have cost the amputation of limbs. Clarence Dally began Röntgen ray work with Mr. Edison some years ago, and was with him at the electrical exhibition in 1896.

MR. MANNING WHITE, who has charge of the lighting department of the Savannah Electric Company, of Savannah, Ga., is visiting the North. He has lately worked out and has shown us an ingenious and simple device which without adding very much to the cost of a plant should serve to check the theft of current pretty thoroughly. He hopes soon to have it on the market.

MESSRS. ED. L. VAN NIEROP & COMPANY, well known merchants in Kobe, Yokohama and Moji (Japan), have recently started an engineering department. This department, under the management of Mr. André Schmidt, mechanical and electrical engineer, who has been during many years with several European concerns, engaged in the designing and constructing of complete power and lighting plants, factory and mining installations. Mr. Schmidt is at preset in Europe for business arrangements and will visit some of the principal cities of this country on his through trip to Japan.

ADMIRAL MELVILLE, Chief of the Bureau of Steam Engineering of the Navy, will be retired this week on Aug. 8, when his commission of chief of bureau expires by limitation. He reached the statuatory age for retiring on Jan. 10 last, but was continued on the active list under his command as chief of bureau as an acknowledgment of his distinguished services in the navy and his great efficiency as head of the Bureau of Steam Engineering, a position which he has filled for sixteen years. In that period the navy has been practically re-created with ships of every type, the machinery for which has been constructed under his supervision. Admiral Melville's first appointment as chief of bureau was made by President Cleveland on Aug. 8, 1887. He filled the position for a longer period than any of his predecessors. During his incumbency the Engineer Corps has been advanced in reputation and numbers, and to-day stands second to no corps of its kind in any of the navies of the world. A number of his protégés and best men have come into the electrical field where they have taken leading positions, and he has also a great many other personal friends in the electrical profession.

EDUCATIONAL.

ROSE POLYTECHNIC INSTITUTE.—President C. L. Mees, of the Rose Polytechnic Institute, Terre Haute, Ind., reports the following as the graduates this year from the electrical department, and the positions they have secured: F. V. Aguilera, General Electric Co.; J. S. Brosius, Westinghouse Electric Co.; C. L. Chamberlain, Wagner Elec. Mfg. Co.; Graham Davies, Western Electric Co.; W. D. Ingle, Oakland Mining Co., Oakland, Ind.; B. C. Jacob, Western Electric Co.; H. S. Kellogg, General Electric Co.; C. J. Kiefer, General Electric Co.; H. W. Palmer, Western Electric Co.; H. B. Pettit, Western Electric Co.; R. J. Schefferly, Automobile Dept., Standard Wheel Co., Terre Haute, Ind.

UNIVERSITY OF TENNESSEE.—The University of Tennessee Press, Knoxville, has issued a neat little vest-pocket book for engineers, a copy of which we have received. The primary object in publishing this book is to bring directly to the attention of the men of affairs of the South the value of technical training in schools and colleges. Aside from a small amount of matter about the engineering departments of the University the editors have endeavored to collect a large amount of information useful to engineers and business men. That they have succeeded, at least fairly well, in getting just the desired information in a convenient form, is shown by the fact, it is stated, that they have demands for this little book from every part of the civilized world.

Trade Notes.

RADIUM.—Admirably adapted to the general reader, and intensely interesting, is the description of the new element, Radium, given by W. A. Shenstone in *The Cornhill Magazine*, and reprinted in *The Living Age* for July 18.

CHARLES E. MILLER, the automobile supply man, etc., will open a branch store at once in "Automobile Row," at 127 West 38th Street, New York City, where a full line of material and supplies will be carried.

THE STROMBERG-CARLSON TELEPHONE MFG. COMPANY, of Rochester, N. Y., and Chicago, Ill., has recently sold a 300-capacity switchboard together with telephones and a complete equipment to the Rushville Telephone Company, of Rushville, Ill.

DIXON'S INDEX is a very handy and shrewd little book of advice to users of lead pencils, classifying them and giving pointers in each case and category

as to the best pencils of Dixon make to be employed for specific work. The pamphlet is prettily got up and contains a lot of interesting information.

THE SWEDISH-AMERICAN TELEPHONE COMPANY, 88 West Jackson Boulevard, Chicago, reports that the party line selective apparatus recently put on the market by it is meeting with great favor and that it is booking orders for this equipment daily. It will be pleased to furnish prospective buyers full particulars upon application.

BERRY ELEC. & MFG. COMPANY.—The Berry Electric & Mfg. Company, of St. Joseph, Mo., has started the manufacture of electric signs and is now turning out quite a number of them. Most of them are equipped with electric flashers. The company's new telephone catalogue is ready for distribution.

THE VOUGHT-BERGER COMPANY, of La Crosse, Wis., is about to put on the market a new and very attractive telephone for party line work. It is said to be unlike any instrument heretofore built, either by it or any of the telephone factories. The company looks forward to an unusually heavy sale of its new No. 45 telephone and believes it will open up an entirely new field in country telephony. The new instrument will be ready for sale about the middle of the month. Pamphlet No. 45, descriptive of this instrument, has been published.

GENERATOR CALL TELEPHONES.—Bulletin No. 4, just issued by the Stromberg-Carlson Telephone Mfg. Company, of Chicago, is devoted to generator call telephones and is a most interesting and valuable brochure on magneto apparatus, including both series and bridging instruments. Each page illustrates a set and gives full data for the advice and guidance of the intending purchaser. A variety of details are gone into very carefully, such as divided circuit or two party selective lines and the "central checking telephone," where all the party stations call through one central point. Several interesting pages are also allotted to telephone parts such as ringers, induction coils, lightning arresters, generators, "triplets," transmitter arms, hook switches, receivers, transmitters, etc. The pamphlet is handsomely gotten up and well printed.

PRECISION LATHES.—Pratt & Whitney Company has just issued one of its standard 6 x 9 booklets on its bench lathe, 10-inch tool makers' lathe, 13-inch engine lathe and 14-inch gibbed carriage engine lathe. The book contains 67 pages and is fully illustrated with excellent half-tone plates. The first 37 pages of the book are taken up with a description of the 7 x 32-inch bench lathe. This machine is described in detail and illustrations are given of more than 30 of the various attachments which may be furnished. The 10-inch tool makers' lathe is also carefully described, and illustrations are given showing the application of the collets and split step chucks to the spindle. There are two views of the 14-inch lathe. A number of important attachments for this are illustrated and described, including the relieving attachment for relieving straight, taper and spiral taps and milling cutters, draw-back collets, step chucks and closers and expanding arbors. While these lathes perhaps are not applicable to rough shop use, any one who cares for good machines or who has to do accurate work will appreciate them.

Record of Electrical Patents.

UNITED STATES PATENTS ISSUED JULY 28, 1903.

[Conducted by Wm. A. Rosenbaum, Patent Attorney, 140 Nassau St., N. Y.]

733,970. TRANSMITTER-ARM; William Kaisling, Chicago, Ill. App. filed April 6, 1903. (See page 226.)

734,099. TELEPHONE-SWITCHBOARD; Charles E. Scribner, Chicago, Ill. App. filed Sept. 25, 1896. (See page 225.)

734,386. TELEPHONE-EXCHANGE; William W. Woodruff, Winchester, Ky. App. filed Sept. 3, 1902. (See page 225.)

734,490. ELECTROLYTIC APPARATUS FOR RECOVERING METALS FROM THEIR COMPOUNDS; Charles E. Baker and Arthur W. Burwell, Cleveland, Ohio. App. filed Nov. 11, 1902. (See page 224.)

734,511. POLE CHANGER AND CROOKES TUBE CONTROLLER; Fred Cedergren, Chicago, Ill. App. filed March 16, 1903. Details.

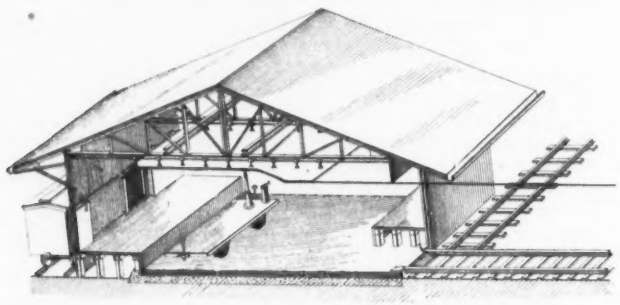
734,610. RAILWAY TRANSFER APPARATUS; Henry H. Porter, Jr., Chicago, Ill. App. filed March 5, 1902. A freight house has a conducting floor and a conducting ceiling connected respectively with a track and a trolley wire, so that a car can pass from the track into the freight house and move about therein in any direction.

734,655. SYSTEM OF ELECTRICAL SIGNALING FOR RAILROADS; Cyrus Barber, Keene, N. H. App. filed March 14, 1902. An arrangement of conductors on a third rail, and collecting devices carried by the train, for signalling purposes between trains and between trains and stations.

734,674. SELF-WINDING ELECTRIC CLOCK; Charles M. Crook, New Britain, Conn. App. filed Oct. 16, 1902. The structure of the magnet and the armature are combined in a peculiar manner with the frame of the clock.

734,689. VIBRATORY TELEGRAPHY; Stephen D. Field, Stockbridge, Mass. App. filed Dec. 18, 1902. An arrangement whereby a vibratory receiving reed will open the local circuit and hold it open while its vibration continues, instead of creating a break at each vibration.

734,699. ELECTRIC ARC LAMP; Frederick W. Gore, Dorchester, Mass.



734,610.—Railway Transfer Apparatus.

App. filed May 24, 1902. Air chambers are arranged at the upper and lower ends of the lamp and co-operate with the carbon carriers to regulate their movement.

734,724. MEANS FOR CONTROLLING ELECTRIC MOTORS; Robert Lundell, New York, N. Y. App. filed March 12, 1903. A controller operating in connection with two compound wound motors and adapted to change the electro-motive force applied to the individual armature circuits and to keep the current from the power circuit uninterrupted through one of the motors while the electromotive force applied to the armature of the other motor is being changed.

734,778. ELECTRICAL HELIX; Richard Varley, Providence, R. I. App. filed Feb. 4, 1903. A helix built up of a number of spirals of flat wire, placed side by side upon a common axis, with adjacent inner and outer ends connected, and the alternate spirals being wound in opposite directions, so that current entering the beginning of the first spiral will flow in the same direction throughout the helix.

734,791. TRANSFORMER; James L. Adams, Jr., Springfield, Ill. App. filed July 5, 1902. The core and magnet casing are so constructed and arranged as to provide for a considerable magnetic leakage at full load, which leakage in conjunction with the impedance in the primary coil serves to limit the current consumption of the primary and the output of the secondary, while at the same time preventing injury to the parts by overheating.

734,793. CIRCUIT CONTROLLER; William W. Alexander, Kansas City, Mo. App. filed July 14, 1902. Details.

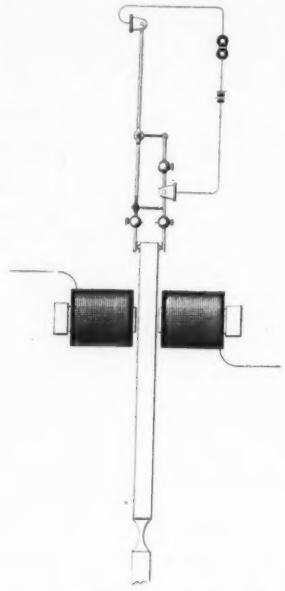
734,826. ELECTRIC BATTERY; Henry Csányi, Felsö-Dobsza, Austria-Hungary. App. filed March 4, 1903. (See page 225.)

734,876. CLUSTER SWITCH; Harvey Hubbell, Bridgeport, Conn. App. filed Nov. 21, 1902. A rotary switch operated by a chain and mounted in the center dome from which the lamps of the cluster project.

734,894. BASKET FOR HOLDING TIN SCRAPS; Martin Laernoes and John Dunn, Streator, Ill. App. filed Nov. 25, 1902. (See page 225.)

734,896. PORTABLE ELECTRIC ACCUMULATOR; Lambertus Alphonus Lammerts, Rotterdam, Netherlands. App. filed June 20, 1902. (See page 225.)

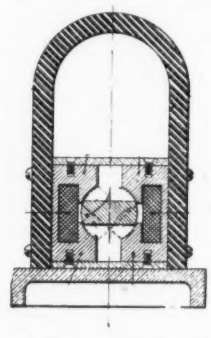
734,905. CIRCUIT CLOSER; Thomas A. Long, Sparrows Point, and George W. Cofran, Baltimore, Md. App. filed Jan. 7, 1903. A pivoted lever held in normal position by a fusible block, the destruction of which permits the lever to move and close an alarm circuit.



734,689.—Vibratory Telegraphy.

734,906. FIRE ALARM MECHANISM; Thomas A. Long, Sparrows Point, and George W. Cofran, Baltimore, Md. App. filed Jan. 7, 1903. An annunciating apparatus operative in connection with the circuit closer of the preceding patent.

734,920. TROLLEY CATCH; George W. Maxwell, Los Angeles, Cal. App. filed March 25, 1903. A cord attached to the dash board at one end passes over a pulley near the top of the pole and thence downward to a suspended weight which permits the pole to rise and fall with the irregularities in the wire, but when the trolley wheel leaves the wire, it releases a dog that grips the rope, thus preventing it from running and holding the pole stationary.



734,955.—Electric Ignition Generator.

734,950. MANUFACTURE OF PEROXID OF LEAD; Erwin Quedenfeldt, Duisburg, Germany. App. filed June 25, 1901. (See page 224.)

734,955. ELECTRIC IGNITION GENERATOR; Benjamin P. Remy, Anderson, Ind. App. filed July 5, 1902. Current is generated by means of an oscillatory inductor moving within a stationary armature.

734,967. ELECTRIC BURGLAR ALARM; Solomon Schwarzschild, Rochester, N. Y. App. filed Feb. 20, 1902. The alarm circuit closer closes the local telephone circuit in the same manner that the lifting of the receiver from the hook operates; central office then getting no answer reports the occurrence to police headquarters.

734,969. FUSE BLOCK OR CUT OUT FOR ELECTRIC CIRCUITS; Lewis C. Scrymser, New York, N. Y. App. filed Oct. 4, 1902. A porcelain base having a number of parallel grooves each containing a fuse; the fuses are all connected together at one end and at the opposite end a plate carrying thumb screws is arranged so that any screw can be worked inward to contact with its respective fuse and throw it into circuit.